PACIFIC ISLANDS PROGRAM

University of Hawaii

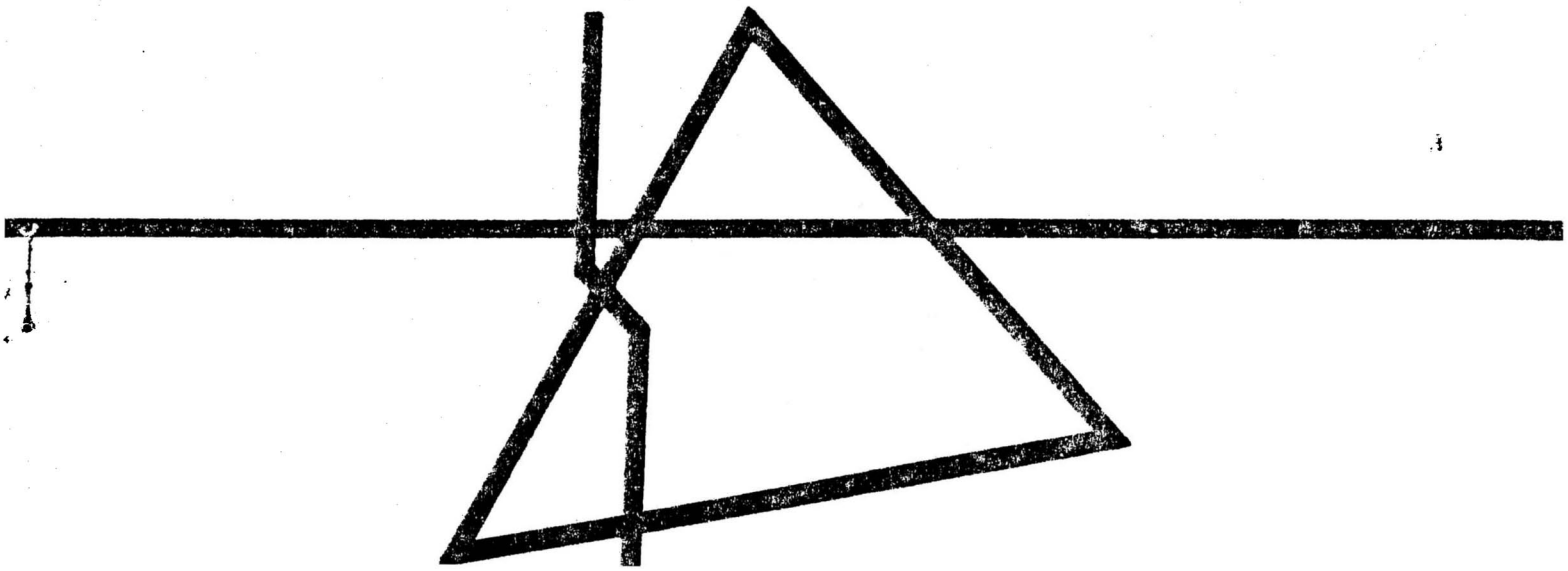
Miscellaneous Work Papers

THE BOUGAINVILLE TARO BLIGHT

Jerry C. Packard

(1975: 1)

Photocopy, Summer 1986



Foreword

Each year the Pacific Islands Studies Program duplicates inexpensively a few Work Papers whose contents justify a wider circulation than that of classroom contact or intra-University circulation. For the most part, these Work Papers consist of students' papers which, in their respective ways, represent a contribution to existing knowledge of the Pacific. Also appearing in the series are bibliographic and other compilations on Pacific Islands subjects, and edited translations of selected materials already in publication. The Work Papers are evidence of the multi-disciplinary interests of the Program, and the wealth of cooperation received from the many Pacific-oriented members of the University and the larger Hawaii community. This paper reproduces with minor revisions a thesis submitted for the degree of Master of Arts in History.

Pacific Islands Studies Program
Room 5, George Hall Annex 8
University of Hawaii
Honolulu, Hawaii

THE BOUGAINVILLE TARO BLIGHT

Jerry C. Packard

PACIFIC ISLANDS STUDIES PROGRAM

University of Hawaii

(1975: 1)

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLE

PREFACE

The influences of food plants and plant diseases on human affairs, although often underemphasized, have not been totally overlooked by historians. W. H. McNeill, author of The Rise of the West, wrote his doctoral dissertation on the influence of the potato on Irish history. While McNeill's study was quite wide in scope, Cecil Woodham-Smith's The Great Hunger, concentrated on the effects of the potato blight, caused by the fungus, Phytophthora infestans. Thus historians have publicized the far-reaching effects of this tragic example of the interaction of man with plants and plant diseases. But other significant cases are perhaps less well-known. For instance, it was coffee rust which caused the total collapse of the coffee industry in Ceylon and the East Indies in the 1880's and 1890's. This had enormous consequences for the producing countries themselves and for millions of people elsewhere. Ceylon changed from the world's leading coffee producer to an important tea-producer, while the coffee planters in the East Indies only reluctantly switched to that extremely lucrative substitute crop, rubber. In the British Isles, the failure of the British coffee industry in Ceylon because of coffee rust, was directly responsible for the decline of coffee drinking, and the subsequent rise in the consumption of tea to what became one of the highest per capita rates in the world. Other examples could be mentioned, such as the disastrous effects of plant diseases and pests on viticulture in France during the 19th century. But without going further, it can be seen that the importance of plant diseases in history is too great to be ignored.

Although caused by the fungus, Phytophthora, the same genus responsible for the Irish Potato Blight, the effects of the taro blight on Bougainville and surrounding islands were not as far-reaching as the events of the above examples.

This study will show, however, that the blight's effects were significantly important to the indigenous people of these islands.

The islands of Bougainville and Buka, separated only by a shallow half-mile wide strait, are situated approximately 500 miles directly east of the New Guinea mainland. Geologically they comprise the northern-most islands of the Solomon Island chain and lie parallel to its northwest-southeast axis between 5° and 7° south latitude. The larger island still carries the name of the French explorer, Louis de Bougainville, who was the first European to record its existence. Although Buka had been sighted by Philip Carteret, the previous year, Bougainville and the members of his expedition sighted and named both islands in 1768. In 1899 the two islands and their Melanesian inhabitants came under German sovereignty and so remained until the Australians seized them in 1914. Between the first and second world wars, the islands were governed by Australia under a League of Nations Mandate. During World War II, the Australians set up, as a branch of the Australian Army, the Australian New Guinea Administrative Unit (ANGAU), which administered Bougainville and Buka until the postwar Provisional Administration took over in May 1946. In December 1946, the old Mandated Territory became a United Nations Trust Territory. The Provisional Administration ended in 1949 when the Papua New Guinea Act officially established the postwar administration.

Readers of this study should be aware that there is some controversy among agricultural scientists as to the significance of the disease, Phytophthora colocasiae, on Bougainville-Buka and in the British Solomons. Plant pathologists have pointed out that the pathogen, P. colocasiae, was not properly identified (using a microscope) until the 1950's. Since the occurrence of a

serious viral disease of taro has come to light in the British Solomons (D. E. Gollifer, personal communications), there has been some speculation that virus diseases rather than Phytophthora were responsible for the decline of taro on Bougainville and neighboring islands. Because of this speculation and the lack of research by scientists into the history of P. colocasiae and its significance in these islands, I have given more detailed accounts of the recorded descriptions of the disease and the subsequent attempts to identify it than would otherwise be required. To other than agricultural specialists, these detailed accounts may appear unnecessary and redundant, but they are included to help more clearly document the true nature of the blight-causing pathogen.

The source materials for the government response, and to a certain extent for indigenous response, were found mainly in government archives, although other written sources were also utilized. In addition, the people of Bougainville-Buka were consulted through the use of oral history interviews. I spent 10½ weeks (mid-October through December 1973) on Bougainville and Buka visiting villages and conducting interviews. These interviews are described in Appendix A.

* * * * *

This study could not have been completed without the cooperation of many individuals and institutions. I am especially indebted to Professor Douglas L. Oliver and his student, Robert Kirk Shoffner, for both encouraging me to undertake this study and assisting me in its completion. A former student of Professor Oliver's, Dr. Eugene Ogan, provided invaluable aid.

In Papua New Guinea my work was immensely facilitated by the full cooperation of Dr. Dorothy Shaw and numerous other members of the Department of Agriculture, Stock, and Fisheries. Professor Donald Denoon, Dr. Peter Bolger, and many others

at the University of Papua New Guinea provided crucial support. On Bougainville I received material help from many residents, both European and Indigenous, but I am especially grateful to Mr. Taco DeVries, then with the DASF, for his generous hospitality and assistance.

Here at the University of Hawaii I wish to express my sincere graditude for the assistance given by Professors A. Gavan Daws and Edward D. Beechert of the History Department, Professor Ronald C. Taylor of the Meteorology Department, and Professor Eduardo E. Trujillo of the Plant Pathology Department. Finally I am grateful to the Food Institute of the East-West Center for financing my research and to my wife, Carole, for her long hours of devoted work, especially in the often hot and dusty surroundings of government archives.

Jerry C. Packard

CHAPTER I

Government Response to the Blight

The earliest known written report concerning the taro blight on Bougainville comes from the files of the Australian New Guinea Administrative Unit (ANGAU). In early 1945, ANGAU patrol officers began to report a blight or "die back" of taro in the Kunua area of Bougainville.[1] (See map in Figure 1) When the ANGAU Regional Headquarters at Lae was notified, the officer in charge suggested that Capt. B. A. O'Connor, ANGAU Entomologist, visit Bougainville to investigate these reports. Capt. O'Connor also acted as a plant pathologist since ANGAU had no one else better qualified. In a July 31, 1945 report Capt. O'Connor described what he had found:

> On July 18 I proceeded to Sipai, and investigated a disease of taro in the surrounding district. This disease is widespread and causes almost total destruction of the crop. In the early stages of the disease, a darkened, watery spot appears on the leaf, which increases in size, the lesions showing concentric rings. Large droplets of pale fluid appear on the damaged tissue, later becoming deep red in colour. The leaf tissue rots away, and falls out from between the main veins leaving the leaf very ragged. The infection then spreads to the petiole, and the plant collapses and dies. Examination of the corm shows it to be rotten. The causative factor is a fungus, *Phytophthora colocasiae*. It is worthy of note that the natives state that this disease has not been known to them before.[2]

Capt. O'Connor's identification of the disease as *Phytophthora colocasiae* was made from field observations without the aid of a microscope. He did, however, have a text on tropical plant diseases by the British mycologist, E. J. Butler, which contains a very complete description and illustration of the disease, *Phytophthora colocasiae*.[3] As will be shown later, Capt. O'Connor's identification was quite

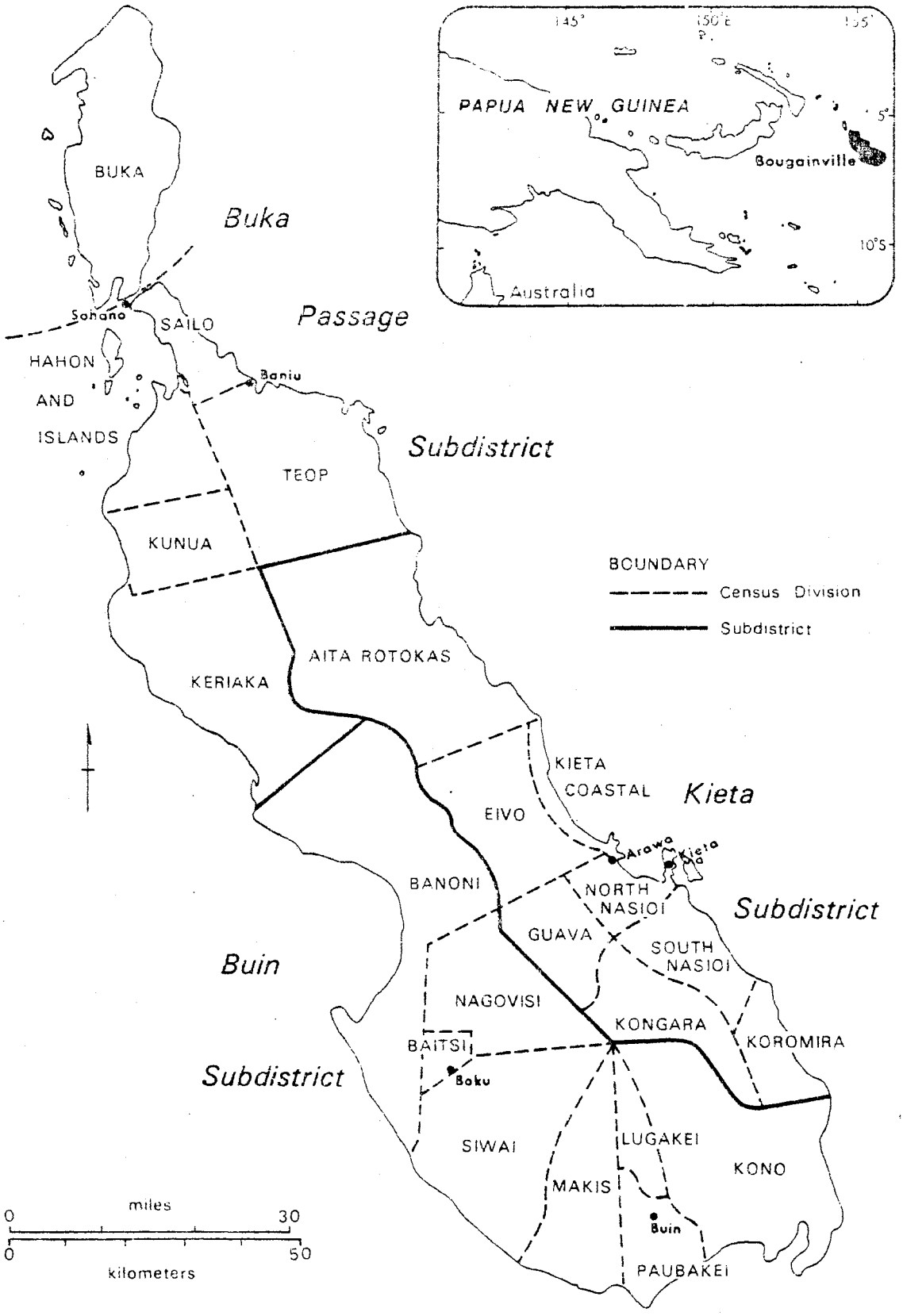


Fig. 1 BOUGAINVILLE-BUKA: SUBDISTRICTS AND CENSUS DIVISIONS

accurate, his description being an exact account of the disease's symptoms.

By October of 1945, the ANGAU District Headquarters on Bougainville noted that, "Regarding the taro disease, reports are now filtering in to the effect that it has caused widespread failure throughout this District."[4] Thus it was ANGAU which provided the first known written record of the taro blight on Bougainville. The blight was to be a lasting problem, for references to its effects occur consistently in the patrol reports of the 1946-1949 Provisional Administration and continue right up into the 1960's in the TPNG Patrol Reports.

Reports from the British Solomons are important to the history of the taro blight because of the close proximity of these islands to Bougainville and the interaction between the two territories concerning the blight. The earliest known written record of taro blight in the British Solomons was from December of 1946. In a memorandum dated Dec. 19, 1946, the Senior Agricultural Officer, D. J. Badcock, after a visit to the Shortland Islands, reported "a disease of taro which has resulted in the total failure of the crop."[7] Badcock later mentioned that the disease was noticed in the Shortlands about June or July of 1946 but that reportedly it was first observed in Bougainville early in the year with 100 percent infection of taro plants.[8] Although Badcock initially guessed that a virus disease was responsible, he later admitted that it was "certainly neither a crinkle or mosaic type of virus." He had suspected a virus because of the virulence of the disease. His

observations were limited to one day only, so his description was rather sketchy at best:

> The observed symptoms indicate that the first sign of infection is the entire plant drooping, at this stage a small brown streak appears down the centre of the stem extending to the root, the infection then appears to spread outwards until all the growing parts above ground rot away. The roots examined by me did not display any obvious signs of infection.[9]

Badcock's first response was to write to the District Commissioner for the Western Solomons recommending that all taro on the Shortland Islands be immediately destroyed, and no new plantings be made for a period of six months so that the disease might be effectively eradicated. He also suggested that the "export of any root crop or soil from the Shortland area should if possible be prevented."[10] Badcock further proposed that the cooperation of the Bougainville Administration should be sought to give the plan a better chance of success. The District Commissioner concurred with Badcock's scheme and suggested that an Agricultural Officer be sent to the Shortlands and then on to Bougainville to see the District Officer in the Buin area. The only stipulation offered by J. A. Allan, the District Commissioner, was that with regard to taro quarantine and destruction, he preferred to "approach the matter by giving administrative advice, not instructions."[11] Badcock found this stipulation to be a little naive:

> I note that it is proposed to implement the above requirements by administrative advice. I would suggest that this is a most unusual method of dealing with such a problem. I can see no reason for believing that a primitive and ignorant people will be more amenable to discipline than relatively advanced European communities, in which the legal restriction of plant movement is invariably applied in such cases.[12]

In March of 1947, the Senior Agriculturalist, John Suckling, was sent on a tour of the Shortlands and Bougainville to organize the taro destruction campaign and to gather more information on the taro disease. In a report on this tour he stated that the taro destruction program was progressing satisfactorily at the time he left. Concerning the disease situation he learned that taro had been the main food crop before the war in the Shortlands. Towards the end of the war the Japanese had begun planting large gardens using planting material from elsewhere. Suckling assumed that some of the planting material had come from Bougainville. The Shortlands people began replanting their own gardens in about October of 1945, using material from the Japanese gardens and probably some from Bougainville. Suckling learned that "little or no taro since then has reached maturity." He has told that about six months after planting, a "wilt disease" occurs which "almost completely defoliates the plant."[13] Suckling added the following to Badcock's earlier description of the disease:

> ....following drooping of the plant, and when the streak appears down the patiole, a p rplish-grey spot appears at the point of attachment of the blade. This extends to the extremities of the leaf until the whole is a brown-grey rotting mass. The corms, apart from being underdeveloped present no appearance of disease at this stage but quickly rot after destruction of the aerial parts.[14]

Suckling could still not identify the causative agent but concluded that the disease was spread mainly through infected planting material. He gathered specimens which he sent to Suva for study and identification. On Bougainville he learned that the taro had "been affected for some years by a similar organism and there is, at present, very little of this crop grown in the Mandated Territory."[15] He reported that the

Bougainville authorities believed that the disease had been introduced by the Japanese, because its appearance was unrecorded until their arrival on the island. It is interesting that Suckling did not learn the identity of the disease from the "new Agricultural Officer" he met on Bougainville.* This officer merely told him that he was awaiting a "qualified member" from the Agriculture Department, who would "attempt some control of the disease."[16] Apparently in March of 1947, the identity of the disease was still unknown to the Bougainville authorities despite Capt. O'Connor's correct identification almost two years earlier.

The District Commissioner for the Western District, J. H. Allan, had accompanied Suckling on his tour of the Shortlands and on his five-day visit to Bougainville. Allan was normally stationed in the New Georgia group which is the administrative center for the Western District (including the Shortlands and Choiseul). Upon reading Suckling's report of the tour, Allan responded with a letter to the Senior Agricultural Officer, listing several areas of disagreement with the findings of the report.

> I gained the impression from residents and officials of Bougainville who were living there immediately prior to the Japanese war that this disease was extant in the island at that time and that by December 1941 it had penetrated as far east as Empress Augusta Bay. Information gathered from Bishop Wade, Father Beck and Shortlands headmen led one to believe that possibly this taro disease was nothing very new and that it had flared up many times in the past, and would, possibly, despite the destruction of present plants and the introduction of new plants, flare up again.[17]

---

*The officer must have been Gordan Wilson. See page 14.

Suckling, in his report of the tour to the Shortlands had expressed the idea that the taro destruction campaign in the Shortlands would soon result in "a reasonably thorough elimination of the plant," and "the futility of maintaining further plantings just now seems to be recognized by the natives."[18] According to Allan, Suckling's optimistic assessment proved to be a little premature. In the letter (quoted above) criticizing Suckling's findings, Allan described how the situation developed:

> On my return to Shortlands after my visit with Mr. Suckling, the Shortlands chiefs and headmen together with Father Beck expressed most bitterly their resentment against the wholesale destruction of taro plants both good and bad. They complained that the disease was gradually working itself out and what was more important to them, they had lost certain rare taro varieties which had been brought to Shortlands years ago and which could not be replaced. The annoyance was so great that a large number of the people were frankly talking of migrating from the Protectorate into the Mandated Territory.[19]

Allan claimed to have done his best to explain to the Shortlands people why their taro had to be destroyed but reluctantly concluded that they found "the basic principles of modern plant husbandry a little difficult to understand."[20] The indigenous Agricultural Instructors who actually undertook the eradication project must have suffered much abuse from the indignant Shortlands people. A Shortland (Faisi) Islander who is now a policeman in Honiara recalled how unpopular these Agricultural Instructors were. He said that they were literally chased about the island and away from endangered taro plots.[21] Suckling, in a response to Allan's report, commented, "That so much indignation had been expressed serves to indicate the thoroughness with which the Agricultural Instructors have carried out their assignment."[22] However, he was again

proven overly optimistic. Revisiting the Shortlands on June 28 or 1947 with the Director of the Territory of Papua-New Guinea (TPNG) Department of Agriculture, Stock, and Fisheries (DASF), W. Cottrell-Dormer, Suckling discovered gardens not only containing taro but containing diseased taro.[23]

It was also during this visit with Cottrell-Dormer that Suckling first learned that the taro disease had been identified as *Phytophthora colocasiae* by the DASF in Port Moresby. Since the DASF director had observed the taro disease in the Shortlands and on Bougainville, Suckling reported that there was "little doubt that this is the same organism which has been responsible for the failure of the taro crop in the Shortlands."[24] In the memorandum where Suckling announced the identity of the disease, he reiterated that he still could not understand the change of position on the part of the shortlands headmen and missions people which occurred after his initial visit in March. All had agreed that it had been impossible to bring any taro plants to maturity because of the disease and that therefore the proposed measures were not unreasonable. They also had indicated at that time, that the disease was a new arrival but now were claiming that the disease had been around a long time. Later in a letter to the DASF in Port Moresby, Suckling tried to explain this change in attitude:

> It would appear that the Shortland people used the disease as an excuse for failure to plant up their gardens during the period following the abandonment of large dumps of food by our troops. In the absence here of an Agronomist, our reactions to the first alarming reports were to organize a plant destruction campaign pending more expert advice. We also endeavoured to quarantine the Islands affected. Seeing their crops uprooted had the effect of changing the minds of the people, who recalled that the disease was not a new

> arrival--that it had always been with them--and that it was now abating.[25]

In March of 1947, Suckling had sent plant and soil specimens gathered from his recent tour to B. E. V. Parham, the Fiji Department of Agriculture Economic Botanist, in order to have the taro disease identified. By July 10, 1947, because he still had not received a reply, Suckling wrote to Parham to inform him of the recent identification of the taro disease.[26] Parham responded on August 19 in a letter to Suckling by first noting that the taro disease had been identified as *Phytophthora colocasiae* and adding:

> A study of the specimens you forwarded and the symptoms described by you tend to confirm this determination. I have been unable to carry out any inoculation studies for lack of proper quarantine and laboratory facilities.[27]

Parham went on to describe *Phytophthora colocasiae* and its world-wide distribution. He acknowledged that he had consulted Butler regarding the description and characteristics of the disease. By checking E. J. Butler's *Fungi and Disease in Plants* (the source used previously by O'Connor) one can see that Parham was quoting from this book almost verbatum. Apparently Parham could not or simply did not identify the disease until he was given the name from Suckling. But once it was suggested that *Phytophthora* might be the causative agent, Parham re-examined the specimens and Suckling's description and effectively verified that such was the case.

Responding to a request by the Secretary to the Government, Suckling, on May 18, 1950, wrote a report on *Phytophthora colocasiae*. He recounted briefly the history of the disease in BSIP since it was

first reported in 1946. He explained why the taro destruction program in the Shortlands had been undertaken, that it had failed, and that although the disease had reportedly abated to a certain extent, it was still present there. He continued, first recounting what had transpired on Choiseul and then summed up his views on the general nature of the disease:

> ....in 1948-49 the fungus was reported to be causing widespread damage to taro on Choiseul. I investigated this on a 5-week tour of the island, confirmed that the fungus was indeed *Phytophthora colocasiae,* failed to establish that the outbreak was due to infected plant material introduced from Bougainville or the Shortlands, and concluded (a) that given favourable climatic and seasonal conditions (b) provided unhealthy host plants were available, particularly in neglected gardens, the disease would assert itself. I suggested further that under certain conditions in any part of the Protectorate outbreaks could occur and this seems to be confirmed by the Fiji authorities who have recently been confronted with an entirely unexplained outbreak of *Phytophthora colocasiae* on Viti Levu. I understand further that the Deputy Director of Agriculture Mr. R. E. Dwyer at Port Moresby, T. N. G. [sic] has expressed a similar opinion in his statement that the disease is in general endemic, but given favourable conditions, heavy prolonged rain, humidity--on poorly tended or weak plants,--it can reach epidemic proportions.[28]

Suckling's above report expressed the conclusions reached by the BSIP Department of Agriculture concerning the outbreak of *Phytophthora colocasiae* in the Western District of the British Solomons. Apparently Suckling was assuming that the fungus had always been present in the environment and the latest outbreak had occurred quite by the chance coincidence of a number of factors. This viewpoint and other aspects of the taro blight in the British Solomons will be further examined after taking a closer look at the blight on Bougainville.

As previously noted, ANGAU had become aware of the taro blight on Bougainville in early 1945 and had declared by October that it had reportedly affected the whole of Bougainville-Buka. The earliest ANGAU patrol reports came almost entirely from the Kunua-Keriaka area of Western Bougainville. This is reasonable because in early 1945 large areas of Bougainville and all of Buka were still occupied by Japanese forces. During the period of hostilities on Bougainville, the functions of the ANGAU patrols "were to collect information and do what they could to rescue natives from occupied areas."[29] Refugees from occupied areas were settled into camps by ANGAU personnel until the war was over, when they were helped to resettle on or near their former village sites. Some villages in the Allied-controlled areas were started on rehabilitation programs even before the official close of the war in September of 1945. Thus ANGAU personnel were very interested in seeing to it that villagers became self-sufficient and independent of government rations as soon as possible. When the taro disease was first discovered, ANGAU realized that it was potentially a cause of some concern. ANGAU Capt. J. M. Joyes, the first to record the outbreak of the disease, stated in an April patrol report from Kunua, "A close watch will be kept as further development of the disease will have serious consequences in the food supplies."[30]

The disease was first reported in Kunua only--early patrols to the Keriaka area found no signs of the blight. Lieut. J. G. Mackay reported in May, 1945 on a patrol to Keriaka, "Taro is healthy and shows no sign of the blight that has affected part of Kunua."[31] However an October patrol report by Lieut. Mackay to the same area stated that in

most of the villages visited, taro had been severely affected by the blight.[32] It is difficult to say that this represented the actual spread of the disease since as will be shown, its severity at a given time and place is highly dependent upon local environmental conditions. In the areas of prolonged Japanese occupation, taro was extremely scarce, owing to Japanese raiding of indigenous gardens and the Japanese practice of consuming not only the taro corms but leaves and stems as well. The following excerpt from a September 1945 Patrol Report on the Rotokas-Keriaka area is representative of conditions then prevailing in many sections of Bougainville-Buka:

> Food position is generally poor, those who remained during occupation have just sufficient to maintain an existence but variety is lacking as Japs took all the taro they could find and cut down the coconuts.....Many sac sac [sago] palms have been destroyed by arty fire...Lack of manpower and the possibility of occupation of gardens has been all against their clearing large areas. Efforts are being made to encourage the people to plant sac sac, coconuts, bananas, taro and paw paw but supplies of root stock are scarce.[33]

Similar reports came from Nagovisi,[34] the Eivo-Banoni area,[35] and from Buka.[36]

By the end of 1945 ANGAU was aware of the lack of taro planting material and of the existence of the blight throughout Bougainville-Buka. In a letter to the Regional ANGAU Headquarters at Lae in October, 1945, the Bougainville ANGAU District Officer, Maj. W. J. Read, mentioned a "long-standing requisition still unfulfilled" for seeds and planting material for indigenous gardens. He also noted that Capt. O'Connor's visit concerning the taro disease had indicated that the "times were against any practical combatant achievement." But he added, "The time is now ripe for the posting of a full-time agriculture

staff here; for only applied expert handling will eradicate the pest."[37] Read's requests and suggestions went unheeded. It was not until after the Provisional Administration had taken control that a full-time agricultural officer was posted to Bougainville and new planting material provided from other districts.

The Provisional Administration took over from ANGAU on Bougainville on May 21, 1946.[38] There was almost a complete change of personnel as many members of ANGAU on Bougainville returned to their pre-war jobs, or went south. It is difficult to determine how much information was passed on to the new personnel by the outgoing ANGAU officers. At least the patrol reports remained so that the new officers had some idea of what had gone on before their arrival. The new Administration personnel apparently were not able to take any immediate action regarding the shortage of taro and other problems resulting from the hardships of the war.

On October 9, 1946, Col. J. K. Murray, the new Administrator, convened a conference to acquaint Papua-New Guinea Missionaries with the policies of his administration. Representatives from every mission along with the heads of the various government departments met for five days in Port Moresby.[39] Bishop Thomas Wade and Monsignor James Hannan represented the Catholic Mission on Bougainville. During the course of the conference, Msgr. Hannan brought up the deplorable conditions which he said then existed on Bougainville due to the hardships of the war. Later published statements indicate that Msgr. Hannan was especially concerned about an exceptionally high death rate which was continuing months after the war had ceased. He attributed the tremendous number

of deaths to a shortage of proper food supplies and requested that the government rush in emergency supplies immediately.

The Administrator was apparently moved by Msgr. Hannan's representation of the situation. On November 18, 1946, the *Sydney Morning Herald* reported that, "A Government food ship is hurrying to Bougainville, where 20,000 natives are facing hunger." The ship was to circle the island delivering and redistributing food. The article mentioned that the people of central and southern Bougainville had suffered most from the war-time devastation and continued with the following details:

> A disease has attacked taro, a main native food, and the natives have had to rely on sweet potato crops. Wild pigs are making inroads on these. At the urgent request of the New Guinea Administration, two tons of maize seed from the Atherton Tableland, coconuts, and several tons of peanuts, rice, and pumpkin seed from other districts, were loaded for Bougainville.
>
> A Government official, Mr. W. A. Ovenstone, flew to Cairns yesterday to buy pigs, fowls, and even dogs for the Bougainville natives. They will be used for breeding.

On a November 5, 1946 radio broadcost over 9PA Port Moresby, the DASF director, Mr. W. Cottrell-Dormer, had announced that:

> ...Assistant District Agricultural Officer, Mr. Gordan Wilson, will shortly travel to Schano, in Bougainville, where he will establish a piggery and a seed farm in order that a practical contribution might be made in helping to overcome the serious malnutrition from which many natives of that region are suffering as a result of enemy activity.[40]

Patrol reports from early in 1947 show that patrol officers began immediately to distribute the maize, peanut, and pumpkin seeds which had been delivered by ship.[41] In November, 1946, J. P. White, the ADO at Kieta, received a "limited amount of taro from Lae." Such planting

material had been on request for months. White planted most of this taro in a plot near the Kieta Sub-district Headquarters and the remainder was distributed to suitable villages for trials and possible multiplication.[42]

Most of the above-mentioned activity seems to have been stimulated by Msgr. Hannan's remarks made at the Missions conference. The newly created DASF had announced that its aim was to "build up a community based on a type of rural peasant proprietorship, for nutritional improvement as well as for economic purposes."[43] However, during the first year of the Provisional Administration, little had been accomplished toward the implementation of an announced extension program. By June 30, 1947, few new projects had been started owing to the need to rehabilitate pre-war installations, and the total number of staff then employed throughout Papua and New Guinea was only 35.[44] Thus, when a full-time agricultural officer was assigned to remote Bougainville District to set up an agricultural station where none had previously existed, there is strong reason to believe that such a move was a direct result of Msgr. Hannan's intervention.

Evidently Msgr. Hannan was not satisfied that the Administration's response had been adequate. While visiting Melbourne in March and April of 1947, he continued his requests for assistance and food supplies for the Bougainville people. His pronouncements received widespread publicity. The following short article appeared in the *New York Times* on April 2nd. It was datelined Melbourne, Australia, Apr. 1.

> Since the Japanese captured Bougainville in the Solomons early in 1942, nearly one quarter of the population of the island has perished and more than one-half of these have died since Japan's capitulation in August, 1945, according

> to Msgr. James Hannan, former Australian Director of all Roman Catholic missions in the Pacific. Msgr. Hannan, who has been working as a missionary in the Solomons during the past year, and who is now visiting Australia, is trying to persuade the Government to rush food to the starving natives.
>
> Bougainville, he said, normally supported 35,000 natives with imports of rice. For nearly three years while the Japanese were there the island supported 90,000.
>
> All the gardens have been destroyed and every clearing bombed. To help the Allies, Msgr. Hannan said, the natives declared war on the Japanese and abandoned their gardens and villages.
>
> Disease, he said, is now taking toll of the undernourished natives. In the center of the island they are not strong enough to remake their gardens. Meanwhile, he said, natives are dying in hundreds. He added that the situation was much the same in New Ireland.[45]

Similar articles appeared in Australian newspapers,[46] and in *Pacific Islands Monthly*.[47]

Mr. E. J. Ward, Minister for External Territories, quickly responded to Msgr. Hannan's pronouncements:

> I recently inquired into conditions on Bougainville and found that rehabilitation had already made considerable progress since the restoration of civil administration in May, 1946....Latest reports indicate that there is sufficient native food, such as maize, sugar, sago and sweet potatoes for present requirements. The despatch of emergency foodstuffs to Bougainville and relief arrangements which the authorities in the territory had planned were put into operation during October and November last.[48]

On April 3rd, Bougainville District Officer, Raleigh Farlow, also replied to Msgr. Hannan's statements. After declaring that recent patrol reports showed there were plenty of peanuts, sweet potatoes, and other "native" foods, he admitted that, there was "certainly a shortage of taro due to some disease left behind by [the] Japanese," but taro was "the only food not in full supply." He said that because of ill-

treatment by the Japanese, the people of Bougainville were in "poor condition" when Australia took over. The people had been fed for a year by ANGAU and were gradually regaining their strength, said Farlow. He granted that the death-rate had been high in certain areas due to starvation caused by the Japanese, but concluded that the position was changing rapidly and the current death-rate was "not out of the ordinary."[49]

In a reply to the Minister and the District Officer, Msgr. Hannan attempted to clarify his views:

> ...Monsignor Hannan said that the natives on Bougainville had some food, but not the right kind of food. They were not literally starving, they were dying as a result of malnutrition. He said that taro was the main food of the inland Bougainville native. He might have ample supplies of other foods, but they were barely sufficient to keep him alive in his present malnourished condition. They had always had meat and fats before the war, and they would continue to die off in certain areas until they got them again.
>
> "The Administration of Papua-New Guinea admitted this when it bought up pigs, goats and fowls for the Bougainville natives last December," said Msgr. Hannan. "They have been at Cairns since. The Government can't get them across because there are no ships. It should fly them across instead of expecting the natives to exist on substitute foods."[50]

The Administration must have been more than a little disturbed about all the unfavorable publicity it was receiving from the controversy stirred up by Msgr. Hannan. It was ironic that this administration was now being accused of neglecting the malnourished and weakened "natives" of Bougainville. For too many European residents, the Administration was achieving a reputation for placing "native" interests before all else (especially before resident European interests) and trying to create "a new paradise on earth for natives."[51] In fact Mr. Ward and

Col. Murray were deeply committed to the welfare of the indigenous people. Even critics of the so-called Ward-Murray regime granted that it was guided by a group of "well-meaning and honest, but thoroughly impractical people."[52]

While the European residents or Territorians (as they liked to call themselves) had few good things to say, the missions of the territory seemed, in general, to be favorably disposed towards the Administration. After all, the Administrator had consulted with them in October, and had scheduled another Missions Conference for May, 1947. It had been reported that the October conference had fostered a "spirit of cooperation and mutual understanding...between [the] Missions and [the] Administration."[53] Thus the Administration must have seriously considered the likelihood that even Msgr. Hannan's renewed attacks were motivated by something other than a mere attempt to discredit the Administration.

After Msgr. Hannan's renewed criticisms of April, the Administration in early May was in a quandary. On April 28, the Acting Government Secretary, Mr. Melrose, wrote a memorandum to the Acting Administrator concerning the Bougainville controversy and what the government's response ought to be.[54] Melrose wrote that the Bougainville question was very confusing and that he was not at all happy about it. While the Department of District Services and Native Affairs (DDS and NA) said there was ample food and the death rate was no longer excessive, the Missionaries insisted that the number of deaths was still abnormally high. "Bishop Wade assigns the cause to 'epidemic' and lowered resistance due to the wartime conditions, and the psychological effect due to the lack of taro," reported Melrose, and "Msgr. Hannan ascribes it to

disease malnutrition and in some cases starvation." Melrose had no information on the nature of the "epidemic" or whether or not it was of recent origin.

Melrose recounted that although the difficulties had been great, some things had been accomplished since the issue was first raised. A fair quantity of seed had been distributed and more seed and some pigs and poultry were soon to be sent. Regarding the taro disease, Melrose wrote, "...[as] a result of Mr. Wilson's [the new agricultural officer in Bougainville] work it is now possible to identify the disease, and Mr. Dormer informs me he is sending Mr. Dwyer [Dir., Div. of Ag. Extension] to Bougainville to direct the steps necessary to combat it."

Melrose suggested that because of the severity of the war-time hardships in Bougainville, a special approach to rehabilitation might be in order. The first task should be for experts from the DDS and NA, the Dept. of Public Health, and the DASF to visit the district so that specific plans could be drawn up and implemented. He felt that the Mission and the Administration might be "at cross purposes" and the Administration might be "falling into the error of believing things to be better than they really are." He concluded that the matter could only be resolved "by investigation by senior officials on the spot."

Finally Melrose expressed concern that the Mission might be exploiting the situation in order to make the Administration look bad:

> There is another aspect of this thing, which to me is disquieting, and that is the persistence with which the Mission keeps raising it. You will see from the file that it was mentioned by Msgr. Hannan at the conference with the missionaries held in Port Moresby in October and also that it has appeared in the New York Times. I am wondering, therefore, if there is a plan by the Roman Catholic hierarchy to discredit the work of the Administration in American eyes.

> I am not aware of the tie-up between the Marist Mission and the American hierarchy of the Roman Catholic Church but we know that the Bishop is an American and that before the war a highly qualified man in the person of Dr. Hennessey was detached from America for work in the Bougainville district... Msgr. Hannan is, of course, an Australian, and but a recent arrival in the field. He too, was detached from important Church work in Australia...If my fears are not groundless, the need for the Administration to approach the task of rehabilitation in Bougainville as a separate undertaking becomes more necessary.

Col. Murray approved of Melrose's suggestion that an "investigation by senior officials on the spot" was the only way to settle the issue. Melrose then called a meeting of department heads in his office on May 16 in order to discuss plans for the upcoming visit to Bougainville District. It was decided that Col. Murray, himself, should lead this "fact finding" mission and that he would be accompanied by Dr. John Gunther, Principal Medical Officer; Mr. J. H. McDonald, Assistant Director of the DDS and NA; Lt.-Col. J. S. Grimshaw, Superintendant of Police; and Mr. W. Cotrell-Dormer, Director of the DASF.[55] The necessary arrangements were made and the District Officer at Sohano was notified that the party would arrive on June 3. For some unforeseen reason the party did not arrive until five days later. *PIM* described the ensuing events:

> Actually, he was due to arrive on June 3, on which day the usual out-station window dressing had been applied; the donning of stiff starched whites, the drill rehearsals of the native police and the general what-have-you preparatory to the arrival of any very high official at a Territorial out-post....None of these preparations was in evidence when His Honour walked ashore from the mine-sweeper "Condamine," to be welcomed by a surprised medical assistant instead of a senior officer--who, however, soon put in an appearance, and, being an old soldier of long experience, carried off the situation with aplomb.[56]

The Administrator's party spent only two hours at Sohano. The D. O., Mr. E. M. Farlow, was picked up and the party proceeded on to visit Numa Numa, Kieta, Buin, and Torokina, where they disembarked.[57] They were later picked up by the administration yacht to continue the tour. Various places were re-visited and the party conducted a survey, on foot, of Southwest Bougainville from June 17th to the 26th.[58] On June 28, the group visited Faisi (Shortland Island) in the British Solomons where they met with Protectorate officials.* Then there was a day and a half stay at Kieta and two days at Sohano. The party took a jeep trip to Gagan Village on Buka and briefly visited the west coast of Bougainville before departing for Rabaul on July 3.

The party had visited mission personnel and planters throughout Bougainville-Buka, so that current difficulties might be explained and grievances aired. A DASF report on the survey of Southwest Bougainville revealed the following findings:

> General impressions of the people and their villages; generally well contented.
>
> Health: A physical examination of the 5,431 people was conducted, which especially sought the clinical manifestations of diet deficiency. The results of this examination fail to reveal any abnormal disease pattern, except perhaps a higher degree of anemia....
>
> Signs of diet deficiency: The people looked healthy and well fed...
>
> Agriculture
>
> General Remarks: ...It was found by observation and questioning that an area of from ½ to 2 acres per adult of food crops was fully planted and in various states of maturity and that additional areas were being planted or prepared for planting...The Japanese system of planting kau kau [sweet potato] in high raised beds had been adopted to a limited extent by one or two but generally speaking the natives have continued with their prewar

*See page 8 for earlier reference to this meeting.

> methods because, they claim, they are limited almost entirely to the digging stick as an agricultural implement.
>
> Pests and Diseases: In agreement with earlier reports a fungus disease, or blight of taro was found to be widespread, not only in cultivated taros but also in indigenous bush species. This disease is caused by *Phytophthora colocasiae* and has long been known in India, Southern Asia and Indonesia. Mr. G. Harvey of the Department of Agriculture, Stock and Fisheries will remain at Schano for some time, and make periodical visits, to carry out a programme of investigations in order to determine whether resistant varieties are available or whether simple control measures suitable for local conditions can be devised. The movement of taros out of Bougainville should be prohibited.[59]

The findings of the Administrator's trip to Bougainville verified the existence of the taro blight but failed to back up Msgr. Hannan's claims regarding malnutrition and an excessive death-rate. The findings concerning the taro disease are difficult to dispute, especially when one considers that the DASF Director, W. Cottrell-Dormer, and George Harvey, an agronomist, were present during the survey of Southwest Bougainville. Col. Murray, himself, was an agricultural expert of considerable note. "For 22 years he had been Principal of Gatton Agricultural College in Queensland, as well as Professor of Agriculture in the University of Queensland."[60] This background in agriculture undoubtedly accounted to a certain extent for his interest in the problems in Bougainville.

The survey's medical findings from the physical examination of 5,431 people in a period of nine days, however, are more difficult to substantiate. It is possible that the findings were accurate concerning the absence of any unusually high incidence of disease and malnutrition, while noting the high incidence of anemia, but the reliability of such a cursory examination must remain open to question. On the

other hand the observations of the Principal Medical Officer, Dr. John Gunther, cannot be ignored. Certainly by the time of Dr. Gunther's visit in mid-1947, the actual cases of extreme malnourishment and starvation reported at the close of the war would no longer have been evident.

The effects of Msgr. Hannan's pronouncements and his possible motives for making them require some discussion. It is possible that Msgr. Hannan had merely been reporting the situation as he saw it. Since he had arrived on Bougainville in 1946, the initial sight of Bougainvillians who had suffered severely from the war may have influenced his thinking on the issue. Shortly after the war, the Native War Damages Compensation Committee, composed of J. V. Barry, J. L. Taylor, and the well-known anthropologist, H. I. Hogbin made the following statements:

> ...in Bougainville those [indigenes] brought into our lines are literally skin and bone....one quarter of the population of Bougainville may have perished....The invasion and war activities...have had effects upon the natives so calamitous and so far removed from anything with which their experience and way of life have made them familiar, that it is beyond their power to cope with them.[61]

It is significant that Bishop Wade did not openly disagree with Msgr. Hannan. According to Secretary Melrose, Bishop Wade had agreed that the death-rate was abnormally high but gave a different explanation for it. He thought that because of the people's weakened condition due to wartime suffering, disease epidemics had taken a higher than usual toll. Bishop Wade also believed that the loss of taro had had so great a psychological impact that it had contributed to a higher death-rate.

Whether Bishop Wade thought Msgr. Hannan was over-reacting is not clear. It does seem likely however, that the Bishop certainly did agree that the health of the Bougainvillians was not yet back to normal. Many observers, both past and present, have felt that Msgr. Hannan's claims were exaggerated. Certain members of the Catholic Mission on Bougainville who were present at the time of the controversy stated that in their view, Msgr. Hannan had over-emphasized the severity of the conditions.[62] Certainly other Europeans on Bougainville at the time agreed. The July, 1947, issue of *PIM* carried an article from an unidentified Bougainville reader, claiming that reports concerning starvation on Bougainville were exaggerated. The article asserted that, "The natives lost all their taro crops; but plenty of kau-kau, tapioc, peanuts, coconuts and fresh fruit remained to them, and they appear to be just as healthy as before the war."

If Msgr. Hannan did in fact exaggerate the severity of the conditions, what was he trying to accomplish? It seems improbable that there was a plot to discredit the Administration in the eyes of the Americans as Melrose had feared. A much more plausible possibility would be that Msgr. Hannan was attempting to draw attention to Bougainville, to "put it on the map," so to speak. Bougainville District was the tail-end of the territory and therefore subject to neglect by the Administration. As a result of Msgr. Hannan's efforts, people from Melbourne to New York knew of Bougainville's problems. The Administrator, Principal Medical Officer, Director of the DASF, and Superintendant of Police had all visited the district. An agricultural officer had been assigned there permanently and an agronomist temporarily. A

full-time medical officer had been assigned to the district, as a result of requests made at the October, 1946 Missions Conference.[63] Food, seeds, and planting material had been sent to help the people regain their prewar standard of living. For a brief period then, Msgr. Hannan had managed to get Col. Murray's Administration to take a special interest in Bougainville. Cottrell-Dormer acknowledged this when he wrote in April, 1948, "...Bougainville is of particular interest to this Administration."[64] Thus if Msgr. Hannan did exaggerate his reports to draw attention to Bougainville, his efforts can be counted as largely successful.

The Administration's activities to combat the taro blight began with the previously mentioned* announcement by the DASF Director concerning Gordan Wilson's transfer to Bougainville District in November, 1946, as the District's new assistant agricultural officer. One of Wilson's first projects was to gather taro planting material from Northern Bougainville and start an experimental plot of taro near the new Agricultural Station at Komarau on the Buka side of Buka Passage. The plot was begun in January, 1947, but by April, Wilson reported that every plant had been infected with the disease.[65] Wilson concluded that the planting material had been contaminated, although it had appeared clean and had been planted in a fairly isolated location. In order to proceed further, Wilson had to know what disease he was dealing with. He therefore dispatched diseased leaf specimens to Port Moresby in hopes of having the disease identified. In his April report he also gave a description of the disease's symptoms.[66] Strangely the DASF had failed to inform Wilson of the identity of the blight-causing

*See page 14

organism. Perhaps B. A. O'Connor's earlier identification had been lost or simply overlooked, because Melrose reported that the identity of the disease was finally learned from Wilson's descriptions. This is all the more difficult to understand because after the war O'Connor was employed by the DASF as an entomologist. He was in fact then at Keravat engaged in research on the pests of cocoa.[67]

In May, Wilson had given a summary of his observations on the taro disease and the existing conditions on Buka and Northern Bougainville.[68] In June R. E. P. Dwyer, Director of the Division of Agricultural Extension, responded to Wilson's report:

> Your summary of observations of the taro disease and general position in Northern Bougainville is noted with considerable interest, and the symptoms described are quite typical of *Phytophthora colocasiae*, of which you have given a full description....specimens of the disease sent from Sohano not arrived in Moresby as yet.[69]

There is no record of the specimens ever having arrived in Port Moresby. But the Department began referring to the taro disease as *Phytophthora colocasiae* from then on. It should be recalled that DASF Director Cottrell-Dormer had informed Suckling at the June meeting in the Shortlands that the disease had been identified as *P. colocasiae*. Later developments confirmed that the disease had been correctly identified, but it is surprising that there is no record of any proper laboratory identification using a microscope during this period.

The Assistant Agronomist, George Harvey, had accompanied Col. Murray and Cottrell-Dormer on the tour of Bougainville and was left at Komarau when the official party departed on July 3rd. Harvey was to determine whether or not blight-resistant taro varieties could be found

or if simple control measures could be developed. His task of collecting different taro varieties for trials was made easier by the willing cooperation of the district officers, the missions, and most significantly, the indigenous people themselves. On July 15 the District Officer announced the purpose of Harvey's work and requested that the ADO's begin collecting all edible taro varieties for shipment to Komarau.[70] The Assistant District Officer for Kieta Sub-District, J. P. White, was especially enthusiastic. He responded on August 14th, writing to the D. O. that he would send with the first available ship all the varieties he had collected.[71] White had received 13 varieties from Lae in November and had managed to collect 25 local varieties, a considerable accomplishment given the wartime destruction of so many varieties by the Japanese. He stated that the people of the Kieta area had shown much interest in his taro plantings and after hearing of the proposed work of the agronomist, were also developing an interest in these activities. White believed very strongly that everything possible should be done to combat what he called the "slimy wilt." He wrote,

> The re-establishment of this staple [taro] on a sound basis, free from the danger of decimation by disease, is of outstanding importance from the psychological as well as the nutritional standpoint.[72]

During the months of July and August, Harvey established disease free plots of taro and organized various trials to test resistance and methods of control. In a report on his work Harvey listed the following experiments:

1. Varietal Resistance. He was still collecting varieties in preparation for commencement of varietal trials early in 1948 by which

time he hoped to have received many additional varieties from Papua and New Guinea.

2. Chemical Control. Using a four-month-diseased taro patch, he began a trial to check the effects of spraying with two different sprays, lime sulphur and "Bardinett". Each spray was tried on two sections, one with diseased leaves removed and the other with diseased leaves remaining. A fifth section was included where diseased leaves were removed but no sprays applied.

3. Alternate Hosts. He found that disease on wild *colocasia* varieties could be transfered to the domesticated varieties and vice versa but that local caladiums failed to pick up the disease from any source. Further studies on alternate hosts were planned when more was known of the disease's habits.

4. Spread of Disease on a leaf. After observing 14 taro leaves and making some 100 drawings, he determined that the method and rate of spreading was dependent upon the position of the parent infection on the leaf. He planned to eventually study the spread of the disease in the plant and in the field.

5. Spread of Disease in the Soil. Soil in five gallon drums was contaminated with diseased leaves and planted with disease-free taro. The plantings were made progressively in different drums whose soil had been contaminated at the same time, to check the longevity of soil contamination. As a control a certain percentage of the drums contained no diseased leaf material.

6. Crop Rotation. Taro gardens were selected for rotation trials to begin after taro was mature. The rotation of tobacco and corn, then

peanuts, then rice, and finally back to taro was to be tried.

7. Crop Sanitation. Certain villages were encouraged to practice it. Trials in designated areas were to begin when the taro became mature.

8. Pathological History and Etiology. Nothing could be accomplished until laboratory equipment was made available.[73]

Besides the above experiments Harvey wanted to establish disease-free taro plots throughout the district. He wrote:

> From a psychological point [of view] and from a prestige angle for both the Department and Administration in general, it would be advantageous if we could establish isolated areas of disease-free taro at Sub-District and mission centres. This would also be beneficial from an experimental point of view.[74]

Before leaving Bougainville towards the end of August, he had established two such plots, one on Sohano Island and another at Hanahan Mission.[75]

By early September, Harvey had returned to the Keravat experimental station after spending only two months on Bougainville. There is no record of Harvey ever having returned to Bougainville to finish the work he started. In a lengthy exchange of letters with DASF headquarters, he continually asked that taro from the rest of the territory be sent to Bougainville so that he might continue his work with disease-free specimens. He also consistantly requested that laboratory equipment be made available. After months of no action on either of these matters, the Director, Cottrell-Dormer, had to admit that little had been accomplished. He wrote in an April 1, 1948 letter to Suckling:

> He [Harvey] has not been able to return to Bougainville owing to his releaving Mr. F. C. Henderson, Agronomist in Charge, at Keravat. Other difficulties have also arisen, the principal one being staff shortage, but it is intended to proceed with the work nevertheless.[76]

In an April 3rd letter to Harvey, the Director gave a slightly different version but admitted that delays were unavoidable:

> It seems that for a number of very practical reasons we cannot expect to make rapid progress with research in taro disease; foremost among these reasons is shipping. I suggest you build up your material at Keravat for later transfer to Bougainville as shipping facilities do exist between that place and Rabaul.[77]

Meanwhile Gordan Wilson remained at Buka Passage, presumably continuing with the experiments set up by Harvey. Whether or not Wilson achieved any significant results from any of the experiments is not known as no records could be found. Wilson wrote occasional reports of his work, but he failed to mention any work other than the resistance trial plots, and a few general remarks stating that observations on control measures were continuing.[78] It seems that the initially enthusiastic plans to do something to re-establish taro as the staple crop began to suffer from delays and neglect. The idea that taro would be replaced by another crop appeared to become more and more accepted. Wilson wrote in November, 1949:

> ...it would appear that sweet potato is now generally accepted by the natives as the staple and the desire to return to taro growing on a large scale is much less frequently expressed than was the case formerly...ease of growing sweet potato probably accounts for this and as medical evidence in a comparison of food values favours the sweet potato slightly, the change cannot be condemned from a purely material viewpoint.[79]

That the DASF had begun to give up on the idea of re-establishing taro is further emphasized by Wilson's trip to the Trobriands in September of 1950. The trip was made to gather seed yams for distribution throughout the district with the hope that Trobriand yams would at least partially make up for the loss of taro as the staple crop. By September 22, 1950, Wilson had distributed some 9 tons of seed yams between Buin, Kieta, Wakunai, Buka Passage, and the Carteret Islands.[80]

The taro problem seems to have been set aside by the Administration in general and by the DASF in particular until early in 1954 when Father W. Fingleton again brought it to the attention of the Dept. of District Services and Native Affairs. As part of a list of several changes, Father Fingleton accused the Administration of failing to help the Buin people maintain their traditional pre-war staple crop of taro. In response to Father Fingleton, the Acting Director of DASF, F. C. Henderson, wrote:

> The taro in the Shortlands and through Bougainville was destroyed by a disease immediately after the war. However as yams, Kongkong taro, sweet potatoes and tapioca all grow readily in this area there is no reason why taro cannot be superseded by these crops. All reports indicate that this has been done. A boatload of yam planting material was brought into this area from the Trobriands when the disease destroyed the crop. Sweet potatoes and other planting material were also distributed where necessary. It is many years now since the change over from taro as a staple to sweet potatoes. I understand that resistant strains of native taro are again appearing through the area. This is normal as investigations have shown that through the Shortlands and Bougainville every 20 years or so, taro disease flares up, destroys the more susceptible strains of taro grown, and then for several decades permits the establishment of taro crops from the resistant strains that have survived the attack. It may well be that an erroneous impression of the food status of this area has been obtained by the native classification of taro as "food" and all other native vegetables purely as "packing". This

> is a common attitude when taro eaters have been forced by varying circumstances to change their staple diet to sweet potatoes or other root crops.[81]

The above statement represents the official view of the DASF regarding the taro blight as of early 1954. While not all members of the DASF would have agreed with this statement, it is interesting that such a view was held by the acting director. Henderson's idea that one root crop is as good as another and there was "no reason" why taro could not be "superseded" represents a considerable lack of appreciation of the cultural importance of taro to the Bougainville people. The lack of evidence for his recurring or cyclical disease theory will be shown later.

Chapter I Notes

1 Capt. J. M. Joyes, ANGAU Patrol Report, April 22, 1945, PNG National Archives, Bougainville District Patrol Reports, 1943-1946, hereafter cited as PNG NA, Boug. Dist. PR, 1943-46.

2 ANGAU Agric. Service, July 31, 1945 File no. 6-4-9, Dept. of Native Affairs, District Ag. New Ireland, now in Konedobu DDA files.

3 Personal communication to author.

4 Covering letter to Capt. Boisen's Nasioi Area Patrol Report, September 12, 1945, PNG NA, Boug. Dist. PR, 1943-46.

5 B. A. McLarty, Buka Patrol Report, April 1949, PNG NA, Boug. PR, 1948-49.

6 J. R. Landman, Keriaka Patrol Report, July 1950, PNG NA, Buin PR, 1950-53.

7 Western Pacific Archives, hereafter cited as WPA, BSIP 1, F2/58.

8 Badcock, letter to Dir. of Ag., Suva, March 14, 1947, WPA, BSIP 1, F2/58.

9 *Ibid.*

10 Badcock memo to DC, Western Solomons, December 19, 1946, WPA, BSIP 1, F2/58.

11 Letter from Sec. to Gov. to Badcock, SAO, January 22, 1947, WPA, BSIP 1, F2/58.

12 Memo to Sec. to Gov. from SAO, Badcock, January 27, 1947, WPA, BSIP 1, F2/58.

13 J. J. Suckling, report to SAO, WPA, BSIP 1, F2/49.

14 *Ibid.*

15 *Ibid.*

16 *Ibid.*

17 Letter to SAO from John Allan, DC, Western Solomons, May 1, 1947, WPA, BSIP 1, F2/49.

18 *Op. cit.*

19 Letter to SAO from Allan, May 1, 1947, WPA, BSIP 1, F2/49.

20 *Ibid.*

21 Interview in Honiara, with Fabiano Kalola of Shortland Island, January 4, 1974.

22 J. J. Suckling, memo to DC Western Solomons, June 3, 1947, WPA, BSIP 1, F2/49.

23 J. J. Suckling, memo to Sec. to Gov., July 7, 1947, WPA, BSIP 1, F2/58.

24 *Ibid.*

25 J. J. Suckling, letter to Dir. Department of Agriculture, Stock and Fisheries, (New Guinea), hereafter cited as DASF, February 11, 1948, DASF Chief Plant Pathologist's Office, File 21-4-3, hereafter cited DASF CPP, F21-4-3.

26 Parham, letter to Suckling, August 19, 1947, DASF CPP, F21-4-3.

27 Suckling, memo to Sec. to Gov. August 5, 1948, WPA, BSIP 1, F2/7.

28 Suckling, memo to Sec. to Gov. May 18, 1940. WPA, BSIP 1, F2/58.

29 Gavin Long, *The Final Campaigns* (Canberra: Australian War Memorial, 1963), p. 135.

30 Capt. J. M. Joyes, ANGAU PR, April 22, 1945, PNG NA, Boug. Dist. PR, 1943-46.

31 Lt. J. G. MacKay, ANGAU PR, May 31, 1945, PNG NA, Boug. Dist. PR, 1943-46.

32 Lt. J. G. MacKay, ANGAU PR, October 3, 1945, PNG NA, Boug. Dist. PR, 1943-46.

33 W. O. Alley, ANGAU PR, September 11, 1945, PNG NA, Boug. Dist. PR, 1943-46.

34 Capt. Slattery, ANGAU PR, July 24, 1945, PNG NA, Boug. Dist. PR, 1943-46.

35 Capt. Boisen, ANGAU PR, September 12, 1945, PNG NA, Boug. Dist. PR, 1943-46.

36 Ltd. Fred Archer, Buka Patrol Report, February 14, 1946, PNG NA, Boug. Dist. PR, 1943-46.

37 Major Read, covering letter of Capt. Boisen's PR to ANGAU, Lae, October 3, 1946, PNG NA, Boug. Dist. PR, 1943-46.

38 Col. J. K. Murray, *The Provisional Administration of the TPNG* (Brisbane: Univ. of Queensland, 1949) p. 23.

39 *Pacific Islands Monthly (PIM)*, November 1946, p. 72.

40 *PIM*, January 1947, p. 63 (Date of broadcast in *Monthly Notes of ASOPA*, December 1946).

41 E.g. see: PR by H. J. Roberts to Kunua from December 13, 1946 to January 1947, PNG NA, Boug. Dist. PR, 1943-46.

42 J. P. White, ADO Kieta, memo to DO Sohano, Aug. 14, 1947, DASF CPP, F21-4-3.

43 Cottrell-Dormer, *PIM*, November 1946, p. 72.

44 *South Pacific, Mo. Notes of ASOPA* (Australian School of Pacific Administration), January-February 1948, p. 98.

45 *New York Times*, April 2, 1947, 14:4.

46 See *Monthly Notes of ASOPA*, April 1947, p. 17.

47 *PIM* April 1947, p. 61.

48 *Monthly Notes*, April 1947, p. 17.

49 *PIM*, April 1947, p. 61.

50 *Monthly Notes*, April 1947, p. 17.

51 *PIM*, October 1949, p. 5.

52 *Ibid.*

53 *PIM*, November 1946, p. 72.

54 Melrose, April 28 memo to Acting Adm., reproduced in Melroses's May 14, 1947 memo to Dept. Heads, PNG NA, DASF Director's Tours, F1-1-29, Pt. 1.

55 *Ibid.*

56 *PIM*, July 1947, p. 83.

57 *PIM*, August 1947, p. 77.

58 DASF brief report on survey of S. W. Bougainville, PNG NA, Ag. 32-1-30, Pt. 1.

59 *Ibid.*

60 Peter Biskup *et al.*, *A Short History of New Guinea* (Sydney: Angus and Robertson, 1968), p. 116.

61 George Odgers, *Air War Against Japan* (Canberra: Aust. War Mem., 1957), p. 449.

62 Personal communication to author (informants wish to remain anonymous).

63 Melrose memo, May 14, 1947, same as note 54, above.

64 Cottrell-Dormer letter to Suckling, April 1, 1948, DASF CPP, F21-4-3.

65 Wilson, report for April 1947, PNG NA, DASF Monthly Reports, Div. Ag. Ext. Boug.

66 *Ibid.*, (Gordan Wilson is the brother of Eric Wilson, now Regional Controller, DASF).

67 Cottrell-Dormer, speech in PIM, January 1947, p. 63.

68 Gordan Wilson, May 1947 report, PNG NA, DASF Monthly Reports, Div. Ag. Ext. Boug.

69 Dwyer, letter to G. Wilson, June 18, 1947, PNG NA, DASF Monthly Reports, Div. Ag. Ext. Boug.

70 C. W. Slattery's memo to ADO's, July 15, 1947, DASF CPP, F21-4-3.

71 J. P. White, memo to C. W. Slattery, August 14, 1947, DASF CPP, F21-4-3.

72 *Ibid.*

73 George Harvey, letter to Cottrell-Dormer, September 24, 1947, DASF CPP, F21-4-3.

74 George Harvey, letter to Cottrell-Dormer, October 15, 1947, DASF CPP, F21-4-3.

75 George Harvey, letter to Cottrell-Dormer, March 23, 1948, DASF CPP, F21-4-3.

76 DASF CPP, F21-4-3.

77 DASF CPP, F21-4-3.

78 Wilson, February 1948 Report, PNG NA, DASF Monthly Reports, Div. Ag. Ext. Boug.

79 Nov. 1949 Report, PNG NA, DASF Monthly Reports, Div. Ag. Ext. Boug. Wilson's ideas on nutritional differences between taro and sweet potato are open to discussion. This topic will be mentioned in Chapter IV.

80 Wilson, Sept. 1950 Report, PNG NA, DASF Monthly Reports, Div. Ag. Ext. Boug.

81 Henderson, memo to Dir., Department of District Services and Native Affairs, February 19, 1954, PNG NA, DASF Administration and Organization, F1-2-2H, Pt. 1.

CHAPTER II

The Scientific Nature of the Blight

The disease organism responsible for the taro blight on Bougainville is the fungus, *Phytophthora colocasiae* Rac. The genus *Phytophthora* is responsible for a number of serious plant diseases affecting potatoes, rubber, cocca, strawberries, lima beans, and avocados. Taro blight, caused by *Phytophthora colocasiae*, is, according to Trujillo, "comparable to late blight of potato in symptomatology and severity."[1]

The nature of the taro blight and its causal organism is indeed strikingly similar to that of the potato blight and its causal fungus, as readers of Cecil Woodham-Smith's, *The Great Hunger*, on the Irish potato famine, will readily notice.

In general the symptoms of this disease are quite distinct from other taro diseases such as viruses. The first symptom of the disease's presence on a taro plant is the appearance of small water-soaked lesions on the leaf. These lesions enlarge to form circular and irregular water-soaked spots, brown to purple in color. In the early stages the lesions exude drops of clear yellow liquid which turn dark red upon drying. Barely visible concentric rings of white fuzz can be seen near the periphery of the lesions progressively farther and farther from the center.[2] Field observations indicate that in the British Solomons the lesions increase in size at a rate of 2.2 cm^2 per day during the first days of development.[3] The petioles (leaf stalks) can also become infected with lesions. If this happens the tissues of the petiole often become so soft that they can no longer support the weight of the leaf and the leaf falls over or breaks off altogether.

The white fuzz which surrounds the lesion is made up of the fungus itself, growing and producing spores on the leaf surface. The spores produced are known as zoosporangia and when mature, they easily break off enabling them to spread to other areas of the same leaf, to other leaves, to other plants, or elsewhere, depending upon the action of wind and rain. They are often transported in water droplets which are splashed about the surrounding area or even washed into distant areas in streams of water, especially during rain storms. In the presence of water droplets at the right temperature, the zoosporangia germinate and release up to eight smaller spores capable of motility and therefore called zoospores. The zoosporangia can also germinate by sending out germ tubes so that a new growth of fungus begins directly without the release of zoospores. Zoospores are very sensitive to temperature and humidity. They are spread about in water droplets just as the zoosporangia and require free moisture for germination which is also by means of germ tubes. Under favorable conditions reproduced in a laboratory, a mature zoosporangia can release zoospores which can germinate in as little as 30 to 45 minutes.[4]

When a zoospore germinates on a new leaf site, the germ tubes are extended down into the leaf structure directly through the surface of the leaf. The branching, threadlike body of the fungus, called the mycelium, now begins to grow inside the leaf itself. It is present in all parts showing external discoloration. Special projections on the mycelium extend into the leaf cells, enabling the fungus to nourish itself by absorbing the protoplasm of its host. As the leaf cells die in the center of the lesion, the threads of the fungus advance outward

to consume new tissue in ever-increasing concentric circles.

The corm can also be attacked by the fungus and in severe cases this often takes place.[5]

It is difficult to know just how far the disease can spread without the help of man. As already mentioned, once an infected plant is established in a garden, spores can rapidly cause infections in neighboring plants. During heavy rain storms, sporangia and spores are apt to be blown or washed to more distant gardens. But it is not likely that spores are carried very great distances by the wind, since their survival is dependent on rigid temperature and humidity requirements. Also no species of *Phytophthora* spores have ever been trapped out of the air despite many attempts to do so.[6] Scattered stands of wild taro can act to help spread the disease by maintaining a source of infection. Since only *Colocasia esculenta* or "true" taro has been found to act as a host to the fungus, no other wild or domesticated plants can be held responsible for spreading the disease.

The most likely means by which the blight is spread is through the distribution of infected planting material by man. This holds true for long and short distances but applies especially to the spread of the blight across such natural barriers as large expanses of salt water, high mountains, or arid regions. When taro from a blighted region is imported into a disease free area, there is a likelihood that the fungus is growing in the planting material or that some form of the organism is present either on the plants or in accompanying soil. Most fungi have the ability to produce "resting spores" which are characterized by thickened cell walls that allow the organism to survive unfavorable environmental conditions. Such spores have been found by growing *Phytophthora*

colocasiae in the laboratory. Although these "resting spores" have not yet been observed in soil or even on planting material, their possible role in the spread of the disease cannot be overlooked.

The earliest record of *Phytophthora colocasiae* Rac. comes from Java in 1900. M. Raciborski first described the disease and reported its widespread distribution on *Colocasia esculenta* leaves as a parasite.[7] In 1905, the well-known British mycologist, E. J. Butler, found the disease to be present in India. He later conducted a rather thorough study of the fungus in the laboratory as well as in the field. In 1912, he published a 28-page article which described in detail the life-cycle of the fungus as observed in laboratory cultures. Also published were many valuable field observations concerning the disease's symptoms and the conditions under which it becomes extremely severe.

Butler reported that a Japanese scientist discovered the disease in Formosa in 1911.[8] By 1916 the disease was reported to be in the Philippines by Gomez.[9] Trujillo states that it was in Hawaii by 1920 and that it was probably introduced from Japan or Taiwan.[10] In 1932 the fungus was noted to be present in the Canton area of China.[11] After the close of World War II when the disease was already a serious problem from Buka to the Northern British Solomons, it was thought to be present elsewhere in Papua New Guinea. In 1948, R. E. P. Dwyer, the head of the DASF Division of Agricultural Extension, wrote: "A very similar disease to that in Bougainville is found around Finschhafen."[12] On another occasion, the same year, he repeated the report of taro disease at Finschhafen and added, "I believe it [is] in isolated areas [of] New Britain and perhaps elsewhere in the Territory."[13] The present DASF Chief Plant Pathologist,

Dr. Dorothy Shaw, states that by 1956, *Phytophthora colocasiae* had been definitely identified on New Britain and New Ireland and that it was later confirmed to be present at Finschhafen.[14] In 1948, the taro blight was reported to have caused severe damage to crops on Nissan Island some 35 miles northwest of Buka.[15]

In order to complete the account of the known distribution of *P. colocasiae* in Western Melanesia, its continued progression down the Solomon Island chain should be noted. By 1959 the disease had reached Malaita,[16] and in 1973 D. E. Gollifer reported that in the Solomons, the disease was "widespread on all of the larger volcanic, Melanesian islands." It was reported to be less prevalent on the smaller low Polynesian islands within the British Solomons.[17]

As previously mentioned, B. E. V. Parham reported an outbreak of *Phytophthora colocasiae* in Fiji in 1948. Bordeaux mixture was sprayed on the infected plots and good control was achieved. The outbreak was completely unexplained as no new importations of taro could be discovered.[18] Since that time, remarkably, there is no record of the disease in any of the Polynesian groups to the east of Fiji, excepting Hawaii. The Micronesian Islands to the north however, have been affected. Trujillo reports that as of 1970, Saipan in the Marianas, and Yap, Palau, Moen, Fefen, Ponape, Nukuoro, and Kapingamarangi of the Western and Eastern Carolines have all been invaded by the blight fungus.[19] And as of last year, 1973, the fungus had been introduced on the Island of Kusaie, because of the lack of adequate quarantine regulations. Reportedly the recent outbreak was quite serious, putting a halt to Kusaie's export of taro to other islands.[20]

Cecil Woodham-Smith, in her history of the Irish Potato Famine, wrote: "Where the potato blight originated and how it came to Europe is a mystery."[21] A similar statement could be made concerning the taro blight and its arrival on Bougainville. As with the potato blight one can only speculate that the disease developed near the origin of the crop. But in the case of taro, the exact area of origin is not known, except that it was probably somewhere in South or Southeast Asia. That the taro blight was first recorded in Java does not necessarily shed any light on where it might have originated. As for its introduction into Bougainville, with the lack of any firm evidence, there can only be speculation.

Trujillo has suggested that the blight fungus reached the Solomons from Java via Australia and New Guinea.[22] With regard to proximity, Indonesia, the Philippines, and Micronesia would all be likely prospects for the source of the disease's introduction into Bougainville. Considering the distances involved, it is probably safe to assume that the disease arrived as a result of an introduction of planting material by a non-indigenous person; perhaps a Chinese trader, a Japanese fisherman, or a European planter or gardener. Micronesia might be considered a possible source if the time of the disease's first appearance there were known. Trujillo suggests that it reached Micronesia from the Philippines but gives no information on the time of its first appearance.[23]

There are conflicting reports concerning when the disease first appeared on Bougainville. The idea that wartime activity caused the taro blight appears to be almost universally held among the indigenous people of Bougainville-Buka. Among them, attributing the cause of the blight to

the war effectively rules out, in most cases, any admission that the blight might have been present before the war. Against this popular indigenous belief, a number of Catholic missionaries on Bougainville-Buka have asserted that the disease arrived shortly before the beginning of the war. Bishop Leo L. Lemay stated that Bishop Wade (now deceased) said the blight began a year or so before the war.[24] Father George Lepping claimed to have observed a taro disease in Northern Buka in 1940. He remembered that the leaves would dry up and die and that very few corms developed.[25] Father F. Miltrup noticed the disease at Piano in the Buin area no later than 1942. He remembered the people calling his attention to it because it was new to them. He recalled that the disease produced brown spots on the leaves approximately 2 inches in diameter, eventually causing the leaves to die.[26]

It should be recalled that J. H. Allan, the District Commissioner for the Western Solomons, during his 1947 visit to Bougainville, obtained a similar account concerning the presence of the blight before the war. He reported that prewar residents and officials claimed that the disease had been extant before the Japanese invasion. However his conclusion, drawn from information provided by Bishop Wade, Father Beck, and Shortlands headmen, that the "taro disease was nothing very new and that it had flared up many times in the past," is not backed up by any other evidence. This conclusion seems to have resulted from a misinterpretation of Bishop Wade's view that the blight arrived a year or so before the war. All the evidence suggests that by maintaining that the disease was not new, the Shortlands headmen, backed up by Father Beck, were merely trying to save their culturally important taro varieties from

destruction by the Agriculture Department. Allan mentioned the uproar which began when certain irreplaceable "rare taro varieties" brought to the Shortlands years before, were destroyed.[27] The Shortlands people, like many of their neighbors to the north, probably cultivated a large number of taro varieties because their ancestors had done so, and fear of the ancestors' wrath might have motivated their efforts to preserve these varieties.[28] Evidently Allan, Father Beck, and later even Agricultural Officer Suckling, were taken in by this very effective ploy. Two years later the Shortlands "Chiefs" were claiming that the disease in fact was a recent arrival and were blaming its introduction on the Japanese.[29] Also in 1949, Suckling reported that "old men" on Choiseul, "stated that the disease is new to them."[30] That is, it was an unfamiliar disease, having been a problem only during the past several years.

Other evidence also suggests that the disease was not a traditionally recognized problem in taro cultivation. Out of information gathered (in 1973) from 11 census districts on Bougainville-Buka, the almost unanimous view of the villagers was that the blight was a recent introduction, the vast majority claiming it was unknown before the war. They usually have no special name for the disease, merely referring to it as "dry leaf" or "rotten leaf" in their respective tongues. This is significant because they recognize and name all other important taro diseases and pests, and state that all were present before the war.

The fact that the disease has only recently spread to other areas in the Pacific suggests that it is also a recent arrival to Bougainville. If the disease had in fact been an early comer to the Pacific Islands, one would expect its distribution to rival at least partially that of

taro itself and of the numerous other species of flora which man has helped distribute throughout the region.

The tropical plant botanist, J. W. Purseglove, has noted that many tropical crops are more successfully grown in areas "far removed from the regions in which they originated."[31] The principal reason for this, states Purseglove, is that in the new areas the crops are unaffected by the "the major diseases and pests which attack them at their centre of origin."[32] Botanists believe that taro originated far to the west, in either South or Southeast Asia. Thus, until the introduction of *Phytophthora colocasiae*, taro in the Pacific Islands seems to have been relatively free of serious plant diseases.[33]

The evidence suggests, then, that the disease was introduced to the Northern Solomons around the time of World War II. The main source of disagreement is whether it was introduced shortly before the war or during the war. Accepting the claim of the Catholic Missionaries and other Europeans, the agronomist, George Harvey, wrote in 1947, "It is true that the disease was present before the war but its actual distribution can not be checked as yet for it is just hearsay."[34]

If the disease was introduced before the war, there is reason to believe that its distribution must have been limited. Prof. Douglas L. Oliver conducted anthropological research in Siwai during 1938 and 1939. He made extensive observations on the cultivation of taro and emphasized its great importance in Siwai society.[35] Yet he made no mention of any serious taro disease, nor does he now recollect that such a disease was then present.[36] Rev. A. H. Voyce, a Methodist missionary in the Siwai-Buin area from 1926 to 1958 (with the exception of the wartime years),

states that he saw nothing of the taro disease before the war. He had always assumed that the disease was a Japanese wartime introduction. His observations are worthy of note because he was an avid gardener while on Bougainville, and continues to raise taro and other tropical and sub-tropical crops at his home on New Zealand's North Island.[37]

The only indigenous people interviewed who stated that the blight was present before the war, were several residents of the villages of Gagan and Lemanmanu on Buka. At Gagan, a Catholic catechist asserted that the blight had arrived in 1941 but was unknown before that time.[38] At Lemanmanu two informants, in separate interviews, said the blight was present before the war but was not yet serious (*em i no ken mekim nogut*). One of the informants, a very elderly man, first stated that the blight was present shortly before the war but admitted that it was not then very serious. He went on to explain that it was only after the Japanese left that the blight became a serious problem, implying that in some way the Japanese were to blame, but not being able to explain exactly how.[39]

The above reports indicate that the blight was probably present in scattered locations throughout Bougainville-Buka shortly before the war. It is unfortunate that no prewar written reports of the blight were found. But the verbal recollections recorded immediately after the war, together with those recorded during 1973, cannot be ignored. It is unlikely that the missionaries, and others who affirm the prewar introduction of the blight, would have mistakenly assigned the arrival date so near to the outbreak of the war. They would more likely have claimed that the blight had long been present or quite logically, that it had been imported during the war.

If there were no reports of the blight's presence before the war, it would be very tempting to assign the blame to the Japanese (as in fact, many people have). After all, many living organisms are known to have been accidentally spread about the world as a result of the massive wartime movements of men and supplies, not to mention the purposeful introductions. The Japanese introduced African snails to New Britain and many other islands as a source of food.[40] They also introduced many food crops to the areas they occupied. To Bougainville they brought squash, eggplant, cabbages, and new varieties of sweet potato.[41] But on Bougainville and Buka no evidence of introduced taro could be found, except that which was introduced postwar in an effort to restock indigenous gardens. All reports from Bougainville-Buka indicate that the Japanese grew only local varieties of taro. Only from the Shortlands is there a report of Japanese introduced taro. An early 1949 Touring Report from the Shortlands reports that the "chiefs" attribute the taro disease to the importation of a Japanese variety of taro with many tubers. The report states, "It is significant that the disease has been most virulent in Ruin, Shortlands, and Northern Choiseul, all areas of Japanese occupation. On this supposition [the] strange variety [was] eradicated by [the] natives."[42]

In the absence of corroborating evidence, the Shortlands report can not be relied upon, no matter how attractive such an interpretation appears to be. The most that can be said is that the blight was probably introduced by a non-indigenous person having access to planting material from some infected area of Asia or Southeast Asia. Based on the earliest reports, the introduction was probably made into Bougainville one or two years before the Japanese invasion of early 1942.

The severity of the taro blight in terms of maximum possible intensity and variability will now be considered. The disease's severity is directly related to the presence of certain optimal environmental conditions. The main factor in the disease's considerable destructive potential is the phenomenal production and germination of large numbers of spores in relatively short periods of time. But in order to produce such large numbers of spores and to have them germinate at their maximum rate, ideal environmental conditions are necessary. The actual growth of the fungus within the plant can occur over a wider range of environmental conditions.

Trujillo has found that maximum spore production occurs at 21°C (69.8°F) and 100% relative humidity.[43] Figures 2 and 3 show how sharply spore production varies with temperature and relative humidity, respectively. Spore germination occurs only in free water, i.e., there must be at least one droplet of water on a leaf before germination can take place. The optimum water temperature range for spore germination is 20-21°C (68-69.8°F), although germination does take place from 20-24°C (68-75.2°). Trujillo found that if water temperature increased to 28°C (82.4°F) or dropped to 16°C (60.8°F), no germination occured. Thus if the temperature remains around 20-21°C (68-69.8°F), with the relative humidity at 100% and given the presence of water droplets from dew or rain, conditions are ideal for the rapid spread of the blight fungus.

Once the leaves are infected, the fungus grows best at 28°C (82.4°F), but continues to grow up to 34°C (93.2°F). The most likely sequence, then, is for the fungus to spread during the night and early morning hours when temperatures are low and humidities are high, and

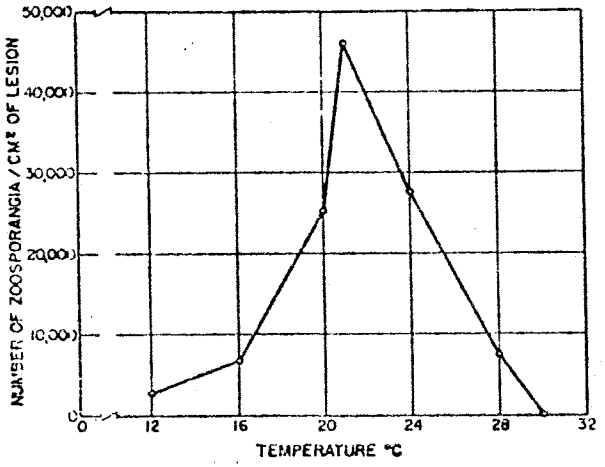


Fig. 2 Effect of temperature on sporulation of *Phytophthora colocasiae* on detached taro leaves maintained at 100% RH for 16 hr.

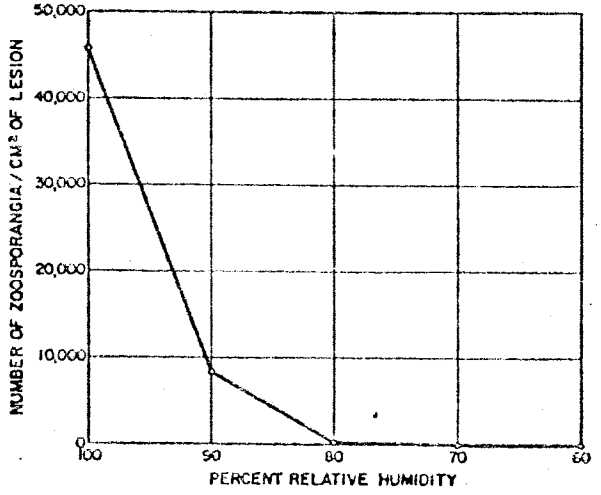


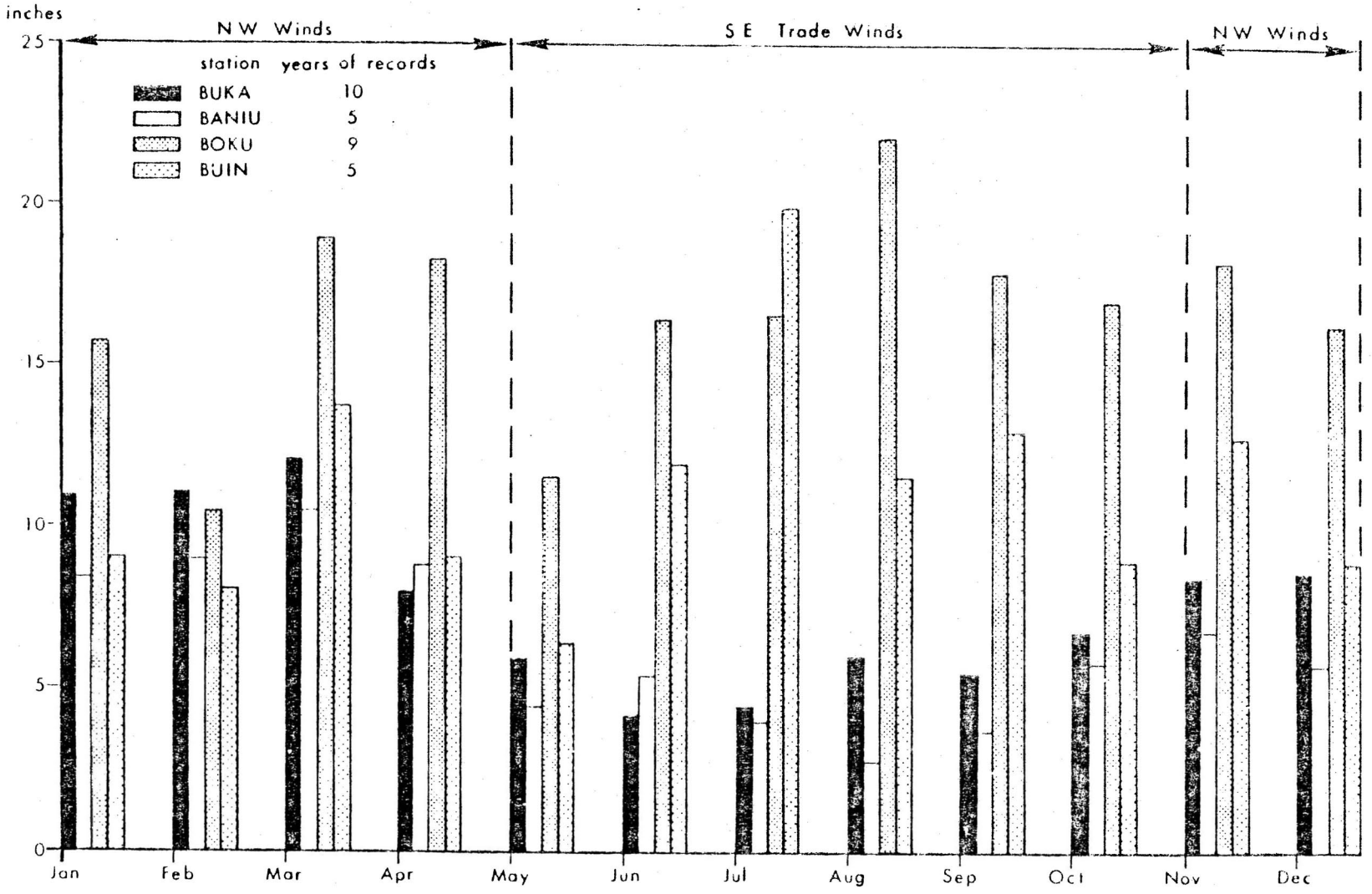
Fig. 3 Effect of humidity on sporulation of *Phytophthora colocasiae* on detached taro leaves maintained at 21 C for 16 hr.

Source: E. E. Trujillo, 1965: 184.

for the lesions to grow during the day when temperatures rise. In Hawaii, Trujillo observed that:

> Epidemics of the disease occurred in the field when the night temperature and relative humidity were optimum for 6-8 hours for 3 to 4 consecutive days and light rains or dews prevailed in the morning.[44]

Now that the ideal conditions for the blight's spread have been discussed, it is appropriate to ask where on Bougainville-Buka are such blight favoring conditions most likely to occur? Climatic records should provide a clue but there are some problems. The above data on optimal environmental conditions were derived from precisely regulated laboratory experiments. On the other hand, the climatic data from Bougainville were undoubtedly obtained from instruments much less accurate than those of a research laboratory. The standard meteorological shelters normally used to house the recording instruments, were designed primarily for temperate zones, and are therefore often responsible for erroneous temperature and relative humidity records.[45] In addition, it is known that standard hygrographs used to record relative humidity give incorrect readings as the relative humidity approaches 100%.[46] Another problem is that records are of different durations for different stations and do not necessarily cover the same years. Nevertheless, several characteristics are immediately discernible. From the mean monthly rainfall data shown in Figure 4 and the mean monthly relative humidity (at 9:00 A.M.) figures shown in Figure 6, it is apparent that, excluding mountainous areas, the southern-most sections of Bougainville are the wettest and most humid. As shown in Figure 5, the mean minimum monthly temperatures are also lowest in Southern Bougainville. An important reason for



Source CSIRO 1967-68 (see bibliography)

Fig. 4 MEAN MONTHLY RAINFALL

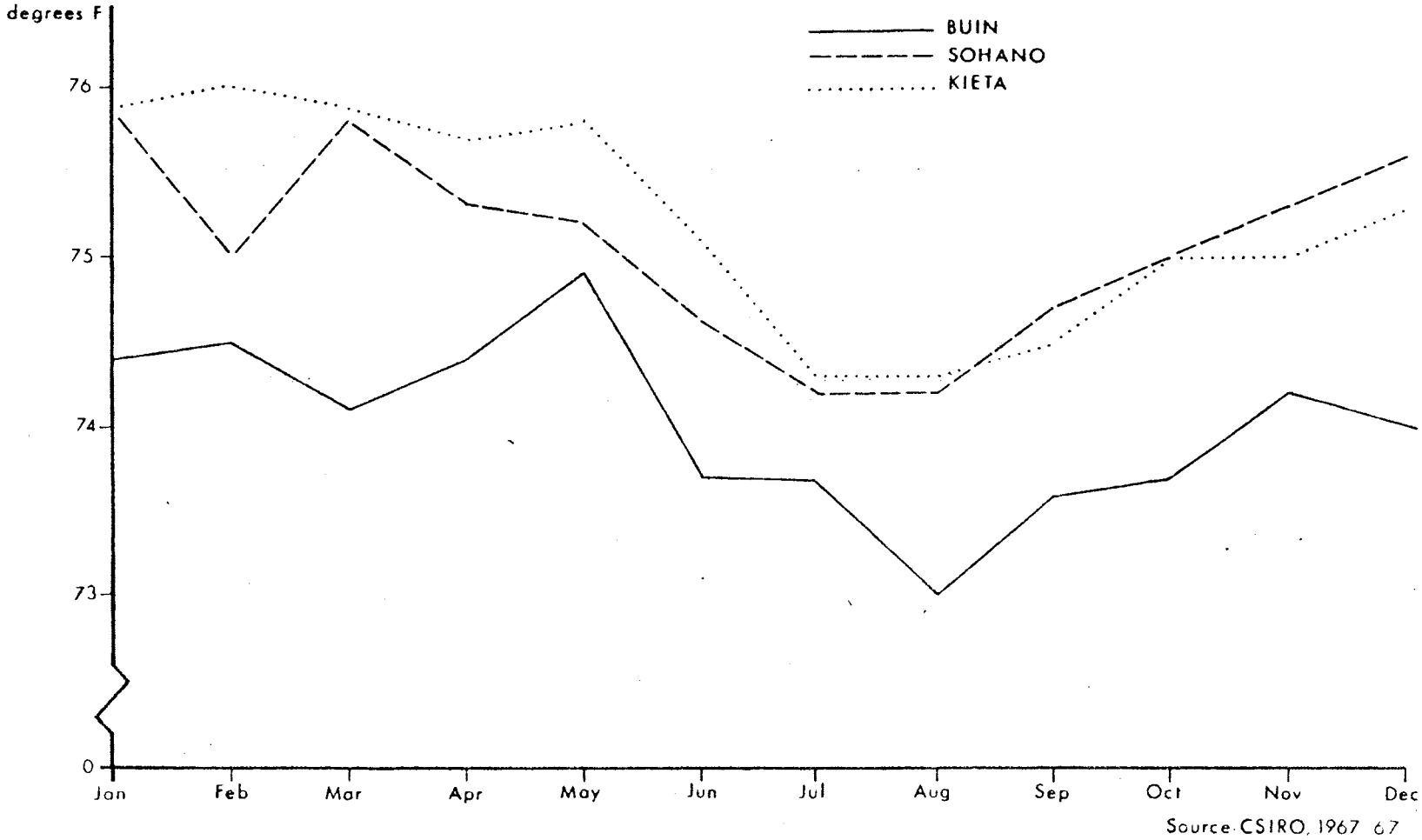
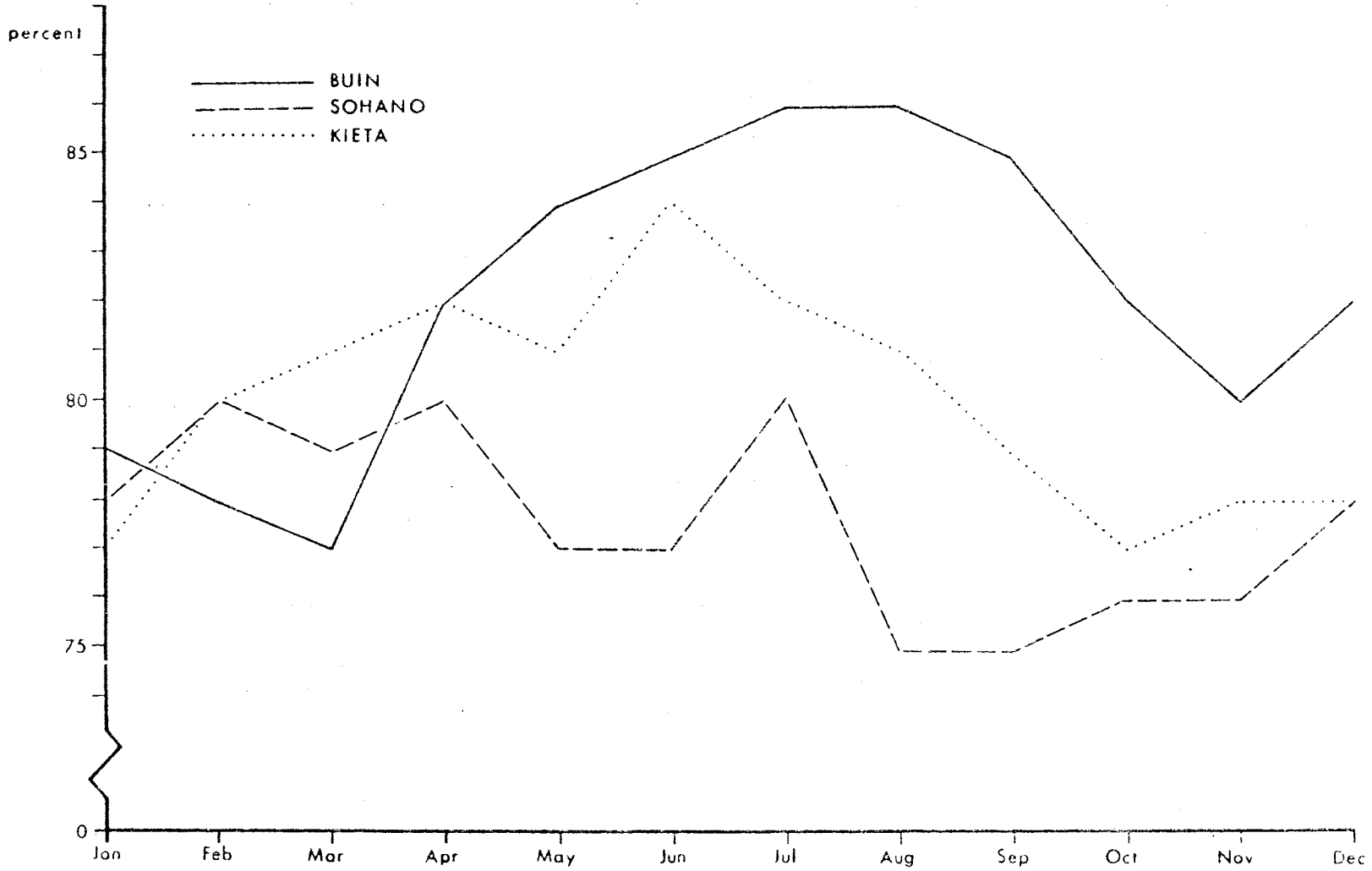


Fig 5 MEAN MONTHLY MINIMUM TEMPERATURE



Source CSIRO 1967 68

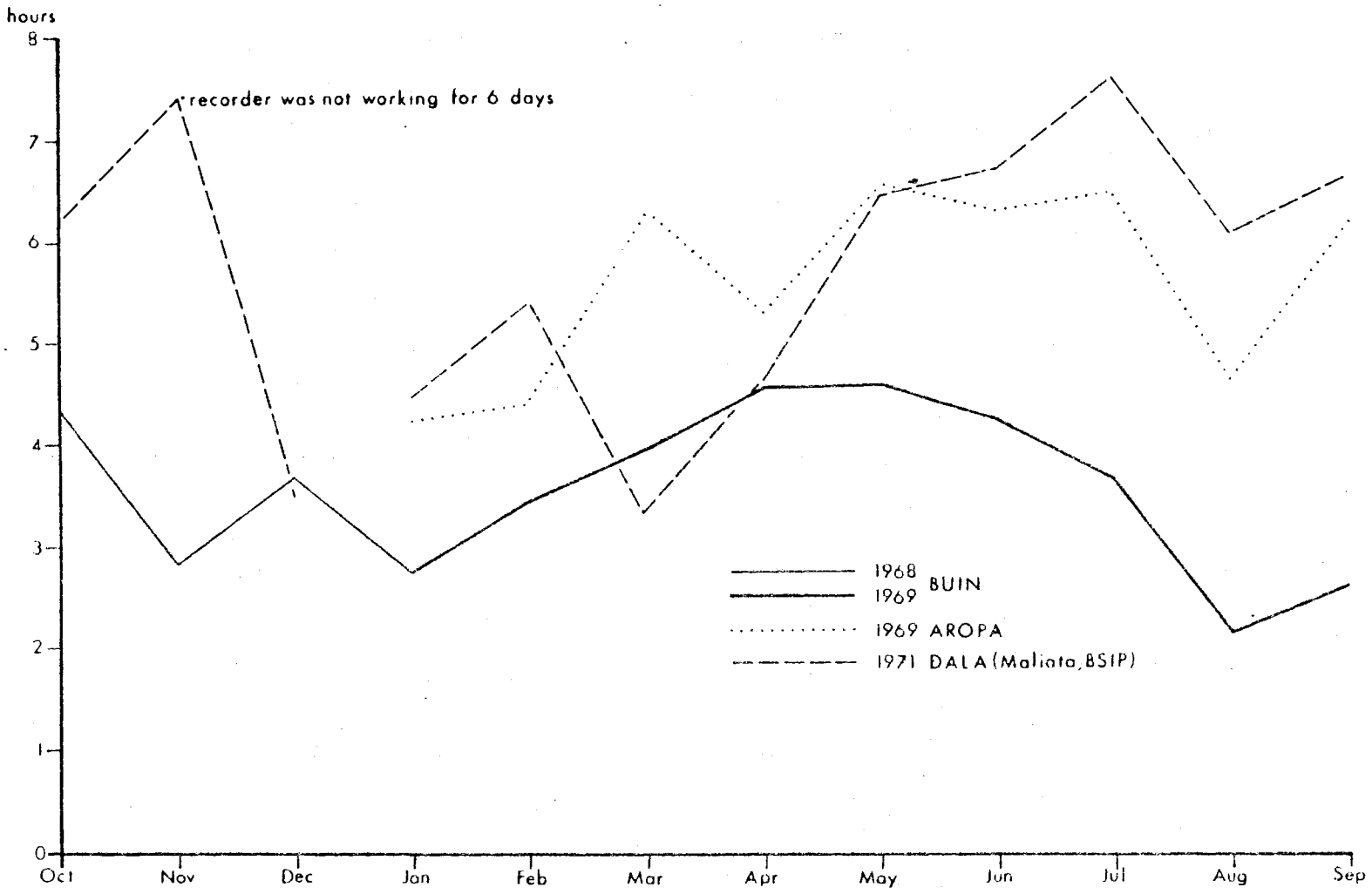
Fig. 6 MEAN MONTHLY RELATIVE HUMIDITY (9:00 A.M.)

these lower minimum temperatures is the effect of cold air drainage down the slopes of the relatively high mountains.

Figure 7 shows that in 1969, Aropa received from 1 to 3½ hours more average daily sunshine than Buin did over the same period. It is quite probable that longer term records would also show that the Buin area receives significantly less sunshine than Aropa and most other low-lying areas to the north of Aropa. This excessively high cloud cover undoubtedly influences the higher humidity and lower daytime temperatures recorded in the Buin region.

Thus the available data shows that throughout the southern-most low-lying sections of Bougainville, weather conditions approaching those most suitable for severe outbreaks of the blight are apt to occur more frequently than elsewhere on Bougainville-Buka. There are several reasons for this. The most important factors influencing the climate of the two islands are the seasonal winds and the regional topography. Between December and April, the northwest winds dominate and rainfall is abundant in almost all areas. From May through November the southeast tradewinds prevail. But during this season heavy rains fall mostly on the southern part of Bougainville while Buka and Northern Bougainville experience a sharp decrease in rainfall. This decrease is due to the rain shadow effect of the southern mountains. The moist tradewinds are forced up the mountain slopes, causing heavy rainfall on the windward side but resulting in only light precipitation in the leeward areas.

In Southern Bougainville the May through November tradewind season results in the coincidence of several blight-favoring climatic conditions. The highest mean monthly precipitation, the highest mean monthly



Sources Sumback, 1970 4 (Aropa & Buin)
Dala Exp Sta Annual Report
1971 58 (Dala)

Fig. 7 AVERAGE DAILY SUNSHINE

relative humidity, and the lowest mean minimum monthly temperatures occur simultaneously. In Northern Bougainville and Buka the lowest mean minimum temperatures occur out of phase with higher humidity and rainfall.

In discussing the occurrence of blight-favoring conditions throughout Bougainville-Buka, the existence of microclimates should be noted. The microclimate near the leaves of taro plants about three feet above the ground in a taro garden is different from the climate recorded in a standard meteorological shelter five to six feet above clipped turf. It is known that temperatures nearer the ground are higher during the day and lower during the night than those normally recorded.[47] The temperatures of leaves of plants near the ground are in between the ground temperature and the air temperature.[48] Generally, leaf temperatures at night are lower than air temperatures while during the day they are higher.[49] The relative humidity close to the foliage of plants is increased due to the plant's transpiration.[50] Also, if the macroclimate (large-scale climate) is a wet one or if the plant foliage forms a canopy over the ground, the relative humidity increases as the ground is approached.[51]

The importance of this information on microclimates near the ground lies in what is predicted about the actual conditions in a Bougainville taro garden. If macroclimate records are consulted, they show other than optimum temperature and humidity conditions for serious blight damage, even in Southern Bougainville. For example, Figure 5 shows that even during the coolest months the mean minimum temperatures are about three degrees above the optimum. But if it is probable that actual leaf

temperatures in a taro garden are likely to be lower than the macroclimate readings, then it is safe to conclude that blight-favoring temperatures occur quite frequently. By the same token, one can assume that (as shown in Figure 6) if 9:00 A.M. macroclimate relative humidity records show readings of 85% and above, the nighttime relative humidity in a taro garden must often approach 100%.

Thus far the mountainous areas of Bougainville have not been discussed with regard to the occurrence of blight-favoring conditions. Since there are no climatic records available for the higher elevations on Bougainville, estimates and extrapolations must be relied upon. It can be assumed that mean temperatures are 3.5°F lower for each 1000 feet rise in elevation.[52] For example, the mountain villages of Kuritave and Damung in the Kongara Census Division are situated above the 2,000 feet level. Using nearby Kieta's mean temperature as a base, these villages could be expected to have a mean annual maximum temperature of 79.8°F and a mean annual minimum of 68°F. With regard to rainfall, the only thing which can be said is that it generally increases with elevation. But with the heavier rainfall, the mean relative humidity would also be expected to increase. Thus in the mountains, the relative humidity would probably be close to the optimum for the blight's spread. Temperature, then, would be the limiting factor, especially when microclimatic conditions are taken into account. It is known that the temperatures near the ground in the mountains show even greater differences from macroclimate readings.[53] Therefore even in a taro garden at only 2000 feet, temperatures below optimum for the blight would be expected almost every night.

To summarize the foregoing, optimum conditions for severe blight damage are apt to occur more frequently throughout the low-lying areas of Southern Bougainville than anywhere else on Bougainville-Buka. In the mountains, lower than optimum nighttime temperatures during the very hours of peak humidity would be expected to limit the severity there.

Now that the conditions most favorable to blight damage have been examined, specific reports on the blight's severity can be better evaluated. There are many apparently conflicting reports concerning the blight's severity. Patrol officers sometimes reported seeing large gardens of healthy young plants and therefore concluded that taro was making a comeback and the effects of the blight were diminishing. In fact, immature widely spaced plants rarely suffer extensive damage from the blight. It is when the leaves begin to form a denser canopy, thus increasing the surrounding humidity and retention of water droplets on the leaves, that the blight becomes serious.[54] But even at this stage, if the weather happens to be relatively dry, the resulting damage although significant, may be tolerable. In order to learn the true severity of the blight in a given area, continual observations are required covering the full range of climatic conditions which occur.

In September of 1947, a patrol officer visiting villages in the Teop area was warned by the villagers against drawing hasty overly optimistic conclusions. He wrote:

> ....A singularly striking feature of the gardens at Lumsis and Aravia, is the good healthy taro being grown at the moment. I enquired as to whether the disease that has struck taro on Bougainville was visible in the present crop. They said no, but intimated, that should rain fall soon, the wilt would set in.[55]

There are other patrol reports claiming that the taro crops have failed altogether. In early 1947 a patrol report from the Kono Census Division in the Buin area stated that, "As elsewhere taro has failed completely, and successive plantings have died long before maturity."[56] A similar report came from the Wakunai area in 1952:

> Taro is grown in limited quantities, but here also the natives complain that the crop begins to wither at a certain state, and eventually dies altogether. This disease is common throughout the Subdistrict.[57]

There is some quite reliable evidence to substantiate the reports maintaining that the blight has resulted in the total destruction of large numbers of plants. Gordan Wilson, the agricultural officer sent to Bougainville District in late 1946, had the job of searching for blight-tolerant varieties of taro. The agricultural station then located on the Buka side of Buka Passage, kept an experimental plot of reportedly disease-tolerant taro varieties. At the end of March, 1951, Wilson filed the following report concerning the experimental plot:

> A small plot containing several [taro] varieties which have been grown here for several years as they had previously shown some degree of tolerance to *Phytophthora* was completely destroyed by the disease during the latter part of the month. The plot was planted in August, 1950, and at the beginning of the month appeared to be in a very healthy state with little sign of disease, but at the end of three weeks rain all foliage had been destroyed by the fungus.[58]

In some cases when all the foliage is destroyed, the corms are able to survive to put out new leaves. But since Wilson said the plot was "completely destroyed", it can be assumed that in this case the corms did not survive. Such a claim is difficult for some modern researchers to believe. For in Hawaii, where much of the research on *Phytophthora*

colocasiae has been conducted, observations have shown that only the foliage has been affected. Likewise at Dala Research Station, on Malaita in the British Solomons, researchers have never observed such lethal severity.[59] The lack of such observations in these two areas undoubtedly reflects the lack of prevailing blight-favoring conditions. Underestimates of the disease's lethal potential began with the first scientific description and naming of the disease. In 1900, Raciborski, stated that on Java it was widely distributed but did not cause much damage to the plant.[60] In 1913, Butler and Kulkarni reported contrary findings from India:

> Raciborski's statement that it causes little damage is too sweeping. Sometimes, in favourable weather for its development, the leaves are so rotted that the entire plant is killed. In 1909, during a period of almost continuous cloud and rain in August, a number of plants died from the disease at Pusa and the growth of the rest was brought to a standstill.[61]

BSIP agriculturalist, John Suckling, reported after an inspection of Shortlands gardens in 1947, that the corms of diseased plants "quickly rot after destruction of the aerial parts."[62] Butler and Kulkarni found that when corms showed wet rot either in the field or during storage, *Phytophthora colocasiae* could be detected in them along with secondary organisms. They concluded that without the invasion by secondary organisms a dry rot occurs as in the potato blight.[63] Trujillo states that it is probably a combination of soil-born organisms including *P. colocasiae* which kills the plant after attacking it in its weakened condition.[64]

Most of the doubts and controversy regarding the severity of the blight stem from a misunderstanding of its extreme dependence upon

specific environmental conditions. Butler and Kulkarni wrote in 1913:

> Nothing is clearer than the close connection between the intensity of the disease and the atmospheric conditions prevalent during the growth period of the host. Much the worst attack noticed at Pusa during the last six years occured in 1909, a year when the rainfall was nearly double the normal, there was almost continuous cloud or rain during August and September, the total precipitation for these two months was 28.44 inches and the 8:00 A.M. relative humidity exceeded 80 per cent on 53 out of 61 days.[65]

In 1925, Gomez reported that in the Philippines:

> ....the disease is severe a week after a continuous rain, owing, perhaps, to the spores [being] splashed by the rain from infected to healthy leaves. In the field it was noted that infection was severe during a few rainy days in August, 1924, and also after continuous rain in October, 1924.[66]

That the disease's most severe outbreaks occur during periods of continuous rain makes *Phytophthora colocasiae* very similar to *Phytophthora infestans*, the cause of the Irish Potato Famine. Cecil Woodham-Smith wrote:

> In Ireland in 1846 conditions favoured the spread of the blight fungus to an extent which has not been recorded before or since....The weather of 1846 was wet--'continual rain' yet warm....[67]

Trujillo has stated that the optimum conditions for the two species are almost identical except that *P. colocasiae* requires slightly warmer temperatures.[68]

The history of the severity of the blight on Bougainville-Buka will be discussed more fully in the next chapter. The important point to note here is that blight-favoring conditions are frequently present in all low-lying areas of Bougainville-Buka. But the southern-most region of Bougainville most consistently displays these favorable conditions.

If Butler and Kulkarni's data on the environmental conditions in India which led to the worst blight in six years are compared with those obtaining every year in Southern Bougainville, the severity of the blight in this region can be better appreciated. Butler and Kulkarni considered a relative humidity of at least 80% at 8 A.M. on 53 out of 61 days to be excessive. Figure 6 shows that the mean relative humidity at 9 A.M. at Buin is 80% or above for 11 out of 12 months of the year. Mitchell reports that at the 600 feet level in Nagovisi, "....during most of any given day the relative humidity is well above 90%, and usually above 95%. ...these periods of high humidity are almost always during the night and afternoon hours."[69] Butler and Kulkarni stated that the figure of 28.44 inches was well above the normal rainfall for the two months of August and September. Figure 4 shows that at Boku, such an amount is exceeded in almost any two-month period throughout the year.

Chapter II Notes

1 E. E. Trujillo, "The Effects of Humidity and Temperature on *Phytophthora* Blight of Taro," *PHYTOPATHOLOGY*, 55, No. 2 (Feb., 1965), 183.

2 Butler and Kulkarni, Same as note 7, below, pp. 234-235.

3 D. E. Gollifer and John F. Brown, "*Phytophthora* Leaf Blight of *Colocasia esculenta* (L) Schott in the British Solomon Islands Protectorate," 1973, p. 5. (unpublished paper)

4 Trujillo (1965), p. 184.

5 Trujillo, per. comm.

6 E. E. Trujillo, personal communication to author.

7 E. J. Butler and G. S. Kulkarni, "*Colocasiae* Blight Caused by *Phytophthora colocasiae* Rac.," *Memoirs of the Dept. of Agric. in India*, Botanic series, 5, No. 4 (1913), 233, citing M. Raciborski, "Parasitisch Algen and Pilze," *Javas* 1 (1900), p. 9.

8 Butler and Kulkarni, p. 233.

9 E. T. Gomez, "Leaf Blight of Gabi," *Philippine Agriculturalist*, 14, No. 7 (1925-26).

10 E. E. Trujillo, "Diseases of the genus *Colocasia* in the Pacific area and their control," *Proc. int. Symp. trop. Root Crops, Trinidad, 1967*, 2 Sect. 4 (1969), 13.

11 *Ibid.*, pp. 13, 18.

12 Handwritten note on margin of letter from George Harvey to DASF Dir., Feb. 19, 1948, DASF Chief Plant Pathologist's Office File 21-4-3. Hereafter cited as DASF CPP, F 21-4-3.

13 Handwritten note on margin of letter from George Harvey to DASF Dir., Mar. 23, 1948, DASF CPP, F 21-4-3.

14 Personal communication to author.

15 D. J. Parrish, Nissan Patrol Report, Oct., 1948, PNG NA, Boug. PR, 1948-49.

16 R. R. Mason to DASF Dir., Aug. 21, 1959, DASF CPP, F 21-4-3.

17 Gollifer and Brown, p. 1.

18 B. E. V. Parhem, "Annual report of the econ. bot. for the yr. 1948," *Coun. Pap. Fuji* 24(1949), 31-35. (*Rev. Appl. Mycol.* 29(1950), 251).

19 E. E. Trujillo, *A List of Diseases of Economic Plants in the Trust Territory of the Pacific Islands* (Saipan: T.T. Dept. of Res. and Dev., Feb. 1971).

20 Trujillo, personal communication to author.

21 Cecil Woodham-Smith, *The Great Hunger*, p. 94.

22 Trujillo (1969), p. 14.

23 *Ibid.*

24 Personal communication to author.

25 Interview, Oct. 18, 1973.

26 Interview, Oct. 22, 1973.

27 Allan to SAO, May 1, 1947, WPA, BSIP List 1, File 2/49.

28 DASF Reg. Controller Eric Wilson told the author that on Buka many "uneconomic" taro varieties were grown because the ancestors had grown them. At Pariro in Buin informants told the author that they too had grown many varieties because their ancestors had done so.

29 Western District Touring Report, Jan. 5-14, 1949, WPA, BSIP 7, F36/4.

30 Touring Report--Choiseul, April, 1949, WPA, BSIP 7, F60/4.

31 J. W. Purseglove, *Tropical Crops: Dicotyledons*, 1(1969), p. 14.

32 *Ibid.*

33 The serious virus disease of Malaita, *Alomae*, is not yet widespread.

34 Letter to DASF Dir., Sept. 24, 1947, DASF CPP, F21-4-3.

35 *A Solomon Island Society*, Chap. 1.

36 Personal communication to author.

37 *Ibid.*

38 Bernard Duga, interview, Dec. 17, 1973.

39 Interview, Dec. 21, 1973.

40 W. Cottrell-Dormer, "Agric. Policy in NG," *PIM*, Jan., 1947, p. 63.

41 Corroborated information from numerous interviews with residents of Bougainville-Buka.

42 West. Dist. Touring Report, Jan. 5-14, 1949, WPA, BSIP 7, F36/4.

43 All scientific data on the blight in this section were taken from Trujillo's "The Effects of Humidity and temperature on *Phytophthora* Blight of Taro" (1965).

44 Trujillo (1965), p. 183.

45 Prof. R. C. Taylor, U. H. Meteorology Dept., personal communication to author.

46 *Ibid.*

47 R. Geiger, *The Climate near the Ground* (Cambridge: Harvard Univ. Press, 1957), pp. 74-5.

48 *Ibid.*, p. 281.

49 p. 276

50 p. 177

51 p. 300

52 J. R. McAlpine, "Climate of Bougainville and Buka Islands" in *Lands of Boug. and Buka Is.* (Melbourne: CSIRO, 1967), p. 66.

53 Geiger, p. 21.

54 E. E. Trujillo and M. Aragaki, "Taro Blight and Its Control," *Hawaii Farm Science*, vol. 13(1964), p. 13.

55 C. A. Forester, Teop Patrol Report, Sept. 22, 1947, Arawa Archives.

56 A. J. Humphries, Jan. 6, 1947, PNG NA, Boug. PR, 1946-48.

57 K. E. Connolly, Rotokas Patrol Report, May 14, 1952, PNG NA, Kieta PR, 1951-53.

58 DASF Reports--Monthly, Div. of Ag. Ext., Bougainville, PNG NA, Acc. 12, Ag. 25-H-1.

59 Personal communication from D. E. Collifer and G. Jackson to author.

60 As quoted by Butler and Kulkarni, p. 233. See note 5, above.

61 Butler and Kulkarni, p. 234.

62 Senior Agriculturalist's Report of March, 1947 Tour to Shortlands, WPA, BSIP 1, F2/49.

63 Butler and Kulkarni, p. 236.

64 Personal communication to author.

65 Butler and Kulkarni, p. 236.

66 Gomez, p. 438.

67 Cecil Woodham-Smith, p. 101.

68 Trujillo (1965), p. 188.

69 D. D. Mitchell, "Gardening for Money" (Ph.D. Thesis, Harvard Univ., 1971), p. 43.

CHAPTER III

The Bougainvillians' Response to the Blight

It is assumed that the taro blight was present on Bougainville-Buka shortly before the war, but little is known of its initial impact. Only towards the close of the war is there any record of the blight's effect on the lives of the indigenous people. But during the period of resettlement and readjustment immediately after the war, the effects of the war and those of the taro blight are very difficult to distinguish. Indeed, the people, themselves, have tended to lump them together by blaming the failure of their taro on wartime activities. To them, loss of their staple crop was yet another catastrophe among the many tragedies which they had been forced to endure, through no fault of their own.

The impact of the blight was delayed in many areas because of the absence of planting material for new gardens. In all areas where there had been Japanese troop concentrations, taro gardens were pillaged to the extent that almost no taro was left by the end of the war. Fred Archer, in his report of the first postwar patrol of Buka, wrote in early 1946 that, "The Japanese ate both tubers and leaves of the taro, and so destroyed most of it."[1] Similarly Capt. Slattery had reported from Nagovisi in July, 1945: "There is no taro...The Japanese destroyed even the stalks necessary for replanting."[2] Many villagers in 1973 remembered that the Japanese consumed even the "*stik belong taro*" (taro stalks) leaving nothing to plant for the next crop.[3]

The Japanese resorted to this pillaging of indigenous gardens only after they had been cut off from their incoming supplies. Although no

Japanese merchant ships arrived after January, 1944[4], captured Japanese records show that submarines constantly delivered limited amounts of food until about August of 1944.[5] Although still short of food, by this time the Japanese had embarked upon a well-planned program of self-sufficiency. In July they began to rely on food produced in their own gardens[6] and by November this production was sustaining all the troops on Bougainville.[7] "During the latter half of 1944 approximately 35 per cent of the Japanese force was on gardening and fishing duty...The gardens grew sweet potatoes [the staple food], corn, egg fruit, beans, peanuts, and green vegetables. Pawpaws, bananas, cocconuts and pine-apples were plentiful. There were chickens in every units' lines."[8] The Japanese on Bougainville-Buka probably would have waited out the war, continuing to support themselves by growing their own food, but after the Australians took over from the Americans (in October of 1944) they were forced to turn again to fighting. The Australian decision to take the offensive surprised the Japanese and, in the end, resulted not only in many Japanese and Australian casualties but in much additional hardship and suffering for the indigenous people. The Australian offensive caused many more Bougainvillians to become refugees and forced the Japanese to pillage indigenous gardens instead of tending to their own.[9]

Many indigenous people had fled their villages before the Australian offensive. But this action increased their numbers and added to the numerous cases of malnutrition and starvation, which resulted from the hardships of living in the bush.[10] At the close of the war, when these people resumed village life, their health was still in a poor state. In many areas (especially in the southwest and westcoast regions) ANGAU

supplied rations to newly resettled villages until their gardens were again producing.[11] Undoubtedly these villagers were thus better able to regain their health while rebuilding their villages and gardens.

In areas where taro planting material was scarce the people were forced to rely on sweet potatoes. Planting material for sweet potatoes can be multiplied much faster than can taro planting material. Sweet potato vines can be divided into very short lengths (1 foot or less) and simply pushed into the soil, so that a whole field can be planted up from just a few parent plants. On the other hand, taro can only be multiplied by waiting for the side shoots to appear off of the main corm, which in most varieties only takes place when the plant begins to reach maturity (from 6 months to a year or more). When taro planting material did finally become available to the villages without it, it was often found that the blight drastically reduced the yield, when not killing the plants outright. In these cases the patrol officers could only advise that all blight-infected plants be burned and that more sweet potatoes be planted.[12]

Villages which planted large areas of taro, not realizing the severity of the blight, probably experienced food shortages until they realized that substitute crops must be relied upon. No detailed records of such shortages were found but they undoubtedly occured until the people witnessed the full destructive nature of the blight.

It seems that due to the availability of both government rations and a quick-maturing (2 to 4 months) alternative crop like sweet potato, the most significant immediate effects of the blight were widespread feelings of disappointment and discouragement. The 1973 interviews were

not very successful in getting the villagers to articulate what their feelings had been when they first realized that taro could no longer be their staple food.[13] Perhaps they had so long ago become resigned to this fate that they had put aside their initial disappointment. Nevertheless there is strong evidence of their initial profound sense of loss. Fred Archer, in the first postwar patrol report from Buka, wrote:

> The absence of the taro is a severe blow to the natives and they feel it...The importance of taro to these natives cannot be too strongly stressed. They state that without it they have not the same strength or resistance to disease as formerly.[14]

During the controversy resulting from Msgr. Hannan's allegations regarding an excessively high death-rate on Bougainville, Bishop Wade stated that in his view, the "psychological effects" due to the loss of taro had been so serious that they were in part responsible for the higher death-rate.[15] The significant point here is not whether "psychological" factors actually influenced the death-rate, but the fact that a sincere witness like Bishop Wade made such an appraisal regarding the seriousness of the loss of taro. Fred Archer's assessment of the situation is also worthy of note. W. J. (Jack) Read of coast-watcher fame, wrote in a foreword attached to Archer's above-quoted patrol report, "Lieut. Archer's twenty years of intimate knowledge of Buka ensures reliance on his comments."

After a December, 1946 patrol to the Mamaramino area of Buin, ADO R. R. Cole wrote: "There appears to be a general apathy present in the area and considering the reasons, the outlook can be appreciated although not encouraged."[16] He added that the lack of taro was an important factor in these feelings of disillusionment and helplessness.

Assistant District Officer, J. P. White, commenting on the significance of taro to the Nasioi people in 1947, wrote: "The re-establishment of this staple on a sound basis, free from the danger of decimation by disease, is of outstanding importance from the psychological as well as the nutritional standpoint."[17] The relative nutritional merits of taro will be considered later, but White's contention that the loss of taro was a serious blow to the Nasioi people, is similar to reports from throughout Bougainville-Buka. In September of 1947, Patrol Officer, J. M. Robinson wrote that in the Pariro area of Buin, varieties of *Xanthosoma* were being successfully grown, but added, "The absence of true taro is still felt by the natives."[18] Kevin Tomlin, an agricultural officer, who was stationed on Bougainville for many years, wrote the following (in 1974) regarding his recollections of the impact of the taro blight on the Bougainville people:

> To Bougainvillians the disease was a national disaster since the impact was so general and happened over a very short length of time. In August 1953 when I first arrived there, people I contacted over the whole island were bemoaning the loss of their taro and having to eat what they regarded as 'pig food'--sweet potato. They had to make the change quickly and the step from taro to Kaukau to them was the equivalent of Americans having to live on ice blocks instead of ice cream.[19]

In reports from several areas there were references to the people feeling weakened due to the lack of taro. Patrol Officer A. J. Humphries, in January of 1947, wrote concerning the inhabitants of what is now the Kono Census Division of the Buin Sub District: "It is considered that their diet at present is insufficient. A solid diet of kaukau makes them look healthy, but there is little or no stamina."[20] In the same month, C. W. Slattery, in a patrol report concerning the

people of the Teopasino area, stated: "As in Buka Island, the lack of their staple food, taro, is reflected in the 'softness' and reduced powers of endurance of many of the men-folk."[21] These reports are cited to show the considerable importance attributed to taro as a strength-giving food. It is quite unlikely that there was any very serious nutrition-related loss of strength. The point is that the people believed in this idea so strongly that they convinced the patrol officers that it was true.

Around the close of the war the people of Bougainville-Buka were faced with the problem of re-establishing their traditional subsistence gardening. As mentioned, there was a widespread shortage of planting material, not only for taro but for other crops. Where the largest Japanese troop concentrations had been located there were large well-prepared gardens, which were producing sweet potatoes and some other vegetables. On Buka[22] and undoubtedly in the Buin-Siwai area as well, the people were able to live off of these gardens until they had time to bring their own into production. The sweet potatoes found in the Japanese gardens were mainly Japanese varieties imported from Japan. Today the people still grow such varieties as *tri mun* (it matures in 3 months), *tokio*, and *tayanko*, all of which mature more quickly than local varieties (probably because they were necessarily summer crops in Japan). The ready availability of planting material from these early yielding Japanese varieties made them an ideal substitute crop to be relied upon until taro could once again be produced. Certainly in the beginning the majority of people saw sweet potato as only a temporary substitute crop. Fred Archer wrote in early 1946 that the people of

Buka "do not favour *kaukau* (sweet potato) as a staple article of diet," but "realize that until they once more get taro 'tops' to plant, that *kaukau* will be their main crop."[23] The Assistant District Officer for the Kieta Sub-District, in an August, 1946 monthly report stated: "In the absence of taro, the natives have developed gardens based upon sweet potato, which they feel to be inferior to taro, the lack of which dominates their thinking on agricultural matters."[24] In Siwai and Buin, especially, sweet potato was commonly considered mainly as "*kaikai bilong pik*" (pig food).[25]

Despite the widespread unpopularity of sweet potato its use was encouraged by the missions, the patrol officers, and even the Principal Medical Officer. Rev. A. H. Voyce, a Methodist missionary who returned to Siwai after the war, and Father Kirk Clemens, stationed at Kunua immediately after the war, both stated that they and other missionaries encouraged the substitution of sweet potato for taro as the staple crop.[25] Patrol officers also often encouraged the planting of sweet potatoes.[27] Fred Archer reported that, after the war, the Administration people "told the natives that *kaukau* had everything that was needed to buoy them up and provide the needed strength." Archer stated that this idea was pushed by Dr. John T. Gunther, then the Principal Medical Officer, but "no one believed him." The indigenous people, in Archer's opinion, saw this as yet "another white man's device to kid them along."[28] Even Gordan Wilson, the agricultural officer who was supposed to be working on the problem of how taro could be re-established was apparently a disciple of Dr. Gunther. In a 1949 monthly report concerning Buka he wrote:

> ...it would appear that the sweet potato is now generally accepted by the natives as the staple...and as medical evidence in a comparison of food values favours the sweet potato slightly the change cannot be condemned from a purely material viewpoint.[29]

In spite of the fact that sweet potato was not a preferred food, the people of Bougainville-Buka had agreed that under the circumstances obtaining immediately after the close of the war, it was the best choice for a temporary substitute.

Before considering the attempts made by the indigenous people to cope with the blight, it is important to understand how they interpreted and explained what had happened to their taro. Since the causal organisms of most plant diseases are difficult to detect with the naked eye, such diseases have throughout history (until recent times) been erroneously explained in a variety of ways, often times relying upon the supernatural. Thus it is not surprising that the people of Bougainville-Buka did not initially and in fact still do not understand the actual cause of the taro blight. Their explanations are generally speaking, quite logical and no less far-fetched than those given by other peoples under similar circumstances. For instance, many people in Western Samoa have attributed the introduction of the bunchy top disease of bananas to Gary Cooper, who apparently in some way displeased the Samoans while in Samoa making the film, *Return to Paradise*.[30] In the Marshall Islands, the people have assigned the cause of breadfruit diseases to missile testing by the U. S. Government.[31]

As previously mentioned, in 1973 the most widespread explanation for the failure of taro on Bougainville-Buka was that the wartime bombing had somehow spoiled the ground. The unprecedented bombing and

strafing of villages and gardens during the war must have had a terrifying effect upon the populace. Ogan reports that the Allied bombing of the Kieta area, "thoroughly demoralized" the Nasioi people of Aropa Valley.[32] The bombing was undoubtedly the most extraordinary and devastating aspect of the war, so it is understandable that the people might attribute to it more damage than was actually caused. There are many variations of the bombing explanation. Among them is the idea that not only did aircraft drop explosive and incendiary bombs on villages and gardens, but spraying of gardens (as houses are sprayed with DDT in anti-malarial campaigns) also occurred. During December 1945 and January, 1946, when Fred Archer conducted the first patrol of Buka after the war, he was told that Allied planes had sprayed gardens, causing the taro plants to die.[33]

Among the very few early records of how the indigenous people explained the decline of their taro is a 1950 patrol report from Keriaka. Patrol Officer J. R. Landman recorded that the people could offer no explanation, "except for a vague suspicion that bombing or the Japanese were in some way responsible."[34] A 1948 patrol report from the Sailo-Teop area stated that concerning the taro decline, "the natives could give no explanation but assumed that the Japanese were responsible."[35] In 1960, Agricultural Officer G. E. Haling, in discussing the explanation for the blight in Buin, wrote: "A popular native concept of its [the taro blight's] origin is that it was introduced by the Japanese wartime occupation."[36] From the Banoni area in 1956 comes another variation of the bombing explanation with something new added. Patrol Officer D. J. Hook, after noting the continuing failure of taro plantings, wrote:

"...the natives blame the exhaust from planes during the war and also a small weed which they say the Japanese introduced."[37]

Kevin Tomlin, who was posted to Bougainville as an agricultural officer in 1953, remembers that concerning the explanations of the blight, "The Japanese were blamed for its introduction in areas not previously affected." Tomlin adds, "In other areas the popular (even if erroneous) belief was that during the night ash from the volcanoes (*'sit bilong paia'*) settled on the leaf and burnt holes..."[38] This interesting explanation is the only one which is wholly natural, that is, not resulting from any actions of humans. There were as well some obviously supernatural explanations. Fred Archer reports that many of the inhabitants of Buka believed the blight to be some kind of divine retribution. Among the Buka people, Archer states, "the heathens... were sure that the Old Gods were wroth and the Christian element conceded that the Lord had smitten them for their lack of faith in the Gospel!"[39] Archer is basing this account on his recollections of the early postwar period. His recollections however tend to be substantiated by interviews with the Buka people in 1973. Residents of Gagan village, while admitting that the blight was present a couple of years before the Japanese invasion, believe that its effects were worsened because they had made offerings of taro to the "*KAMISAMA*" or "*haus lotu*" set up by the Japanese for ancestor worship. Offerings to these shrines containing the bones of the *tumbuna* (ancestors) were seen as acts which went against the "*tru*" God, thus the blight.[40] The residents of Gagan also mentioned that they believed that the Japanese practice of using human excrement as manure in the gardens introduced a small *snek* (worm)

which also had helped to spoil their taro. It was plain that this practice had been thoroughly revolting to the Gagan people.[41]

In interviews (in 1973) with people from 27 villages in 10 census divisions (See Appendix A), almost all explanations for the blight involved some form of "*medisen*" being applied or left behind, purposely or accidentally, during the war. In addition, it is widely believed, that to make matters worse, weeds were purposely released from Allied aircraft to choke out gardens. Not surprisingly, people in neighboring villages tended to have the same point of view with regard to the taro blight and its cause.

In the Nasioi speaking areas of Kongara, Aropa Valley, and Kieta, the common view was that the bombing had been responsible for the failure of their taro. Some informants merely indicated that it had been the bombing, without giving any further explanation. Others said that the blight had been caused by "*medisen bilong bom*". Several mentioned seeing a white powder on the leaves of plants after bombing had taken place and interpreted the ash-like powder to be some kind of poison which eventually resulted in the "*sik bilong taro.*"[42] Most people used the Pidgin word *bom* but some used the word *sprei* or spray. The word *sprei* is familiar to many Pidgin speakers because of frequent postwar spraying with DDT in anti-malarial campaigns. Nearly all the people were sure that gardens had been purposely bombed or sprayed during the war. But when the people of Tourepera Village, located on the beach near Kieta, were asked why the mountain people grew more taro than they did, an explanation unrelated to the war was offered. They replied, "*Graun i kold long maunten na taro i kampap gut.*" (The ground in the mountains is cold and taro grows well there.)[43]

At Konga and its neighboring villages in Siwai, the standard explanation for the loss of taro was: "*Medisen bilong bom i mekim nogut graun.*" Some people left out the term bomb, saying only that airplanes had dumped "*medisen*" onto Japanese gardens to kill the crops and this had resulted in the "*sik bilong taro.*" One man, apparently a type of original thinker, had a slightly different explanation. He maintained that such things as petrol and diesel oil had drained into the ground during the war (probably because of all the vehicles which were brought in) and had caused so much contamination that taro would no longer grow.[44] Another man said that bombs had spilled "*medisen*" onto the ground and it had soaked in; resulting in spoiled taro. He went on to explain that this had been especially serious in the Siwai area, where the ground was so level. In the mountains, he said, there were plenty of streams and ditches so that the *medisen* could drain out, but in Siwai it had remained in the ground.[45] Many of the Siwai people interviewed said that taro still grows in the mountains because fewer bombs were dropped there--most of the fighting had been in the level areas of Siwai.

The Buin people interviewed, from some of the villages near the town of Buin, gave explanations very similar to their neighbors in Siwai. Most people thought *medisen* from bombs had been responsible for spoiling their taro. One woman believed the Japanese had left behind some *medisen* which was to blame.[46] A man from Aku Village believed that allied spraying for mosquitoes had ruined the taro.[47] Several older men in Pariro Village stated emphatically that they had noticed that the leaves of their taro began to die immediately after allied planes began

attacking the Japanese based in Buin--empirical proof of the cause of the taro blight in their opinion. The Buin people also stated that taro can still be grown in the mountains because there had been less fighting and bombing there.

In the Teop area, bombing and *medisen* from the war appear to be the prevalent explanations for the taro blight.[49] When asked why taro now grows better in the mountains, residents of Rarie (a mountain village) replied that in the mountains they have *smo* (fog or mist) which makes it cold. They said that near the beach it was too hot for taro.[50]

Villagers, interviewed from Halia speaking areas disagreed on the cause of the taro blight. At Siara, on the east coast of Bougainville's northern-most peninsula, the opinion was that *medisen* from the war had spoiled their taro.[51] In Ieta village on Buka Passage, similarly the explanation was that *medisen* from wartime bombing had spoiled the ground for taro growing.[52] But at Hanahan I, some people said the blight had been caused by smoke from the war. Others said that the blight was a "*sik bilong Japan*," the Japanese had brought it to Buka. One man thought the blight might have been present before the war but did not know how it came.[53] At Lemanmanu, at the northern end of Buka, those interviewed said the blight arrived before the war, but did not know its origin. One very old man said it was present before the war, but became much more serious after the war.[54]

The idea that "*medisen*" had been sprayed into the gardens during the war is doubted by many Europeans today. But the truth is that although such spraying of gardens was not responsible for the taro blight,

spraying did in fact occur. Robert Sherrod, in his book, *History of Marine Corps Aviation in World War II* (Washington: Combat Forces Press, 1952), p. 210, after describing the March, 1944 Japanese attack on Torokina, wrote:

> General Hyakutake had lost 5,469 of his troops in the attack on the perimeter, against 263 of Griswold's soldiers. He planned another offensive for May, but he had to put his hungry soldiers to growing food after the rice ration fell from 700 grams daily (before the Torokina landing) to 250 grams in April to nothing in September. Strike Command was ordered to help along this food shortage by 'potato runs'. Altogether, 2,500 gallons of Diesel oil were dropped on the Japanese vegetable gardens, but the success of the experiment was doubted, even by the TBF pilots who sprayed the oil.[55]

Reportedly the oil was dropped only on Japanese gardens, but the pilots could not be relied upon to distinguish Japanese gardens from those of the indigenous people. After a reconnaissance flight over Bougainville, Capt. R. G. Ormsby of ANGAU wrote on August 2, 1944: "Many Jap gardens were noticed. They are easily distinguished from native gardens by the manner in which they are laid out. This point is constantly being explained to intelligence officers for use in briefing pilots."[56] The implication is that the pilots needed to be convinced that they should distinguish between Japanese and indigenous gardens. Sherrod reported that American pilots, especially new arrivals, tended to think of everything behind enemy lines as a ready target, ignoring the fact that "the country on the other side was friendly, too, except in spots controlled by the enemy."[57] Therefore, it is very likely that many indigenous gardens were sprayed along with those of the Japanese.

It is interesting to note how the people responded when asked why sweet potato had not been spoiled by the bombing and spraying. In nearly every case when this question was asked, the answer was something like: "*Kaukau, em i rop nating*," sweet potato is only a vine. In Siwai the most interesting explanation was given. On several occasions Siwai people said that sweet potato couldn't feel the *medisen* because it was only a vine like any common vine growing in the bush. One Siwai man said that sweet potato was only a *rop* (vine) while taro was a *diwai* (tree or shrub). Another said that taro was like a man, it could feel sick, but sweet potato was only a vine.[58] At Buin, some residents of Mamaromino Village said that sweet potato wasn't ruined by the bombing because it grows like a wild bush vine, you can even throw it away (or discard it) and it still begins growing again.[59] These explanations provide some indication of the relative value placed on the successful growing and consuming of taro versus sweet potato.

Up until around the time of World War II, the people of Bougainville-Buka had relied on taro as their staple food, just as their ancestors had, generation upon generation. Then something from the war, some foreign substance or *medisen*, was introduced which caused the leaves of their taro to wither and die, either killing the plant altogether, or resulting in an insufficient amount of food. Their explanations for the taro failure have been considered. Now the question arises, how did the people act to try to cope with the new situation?

After the war, once the people had gotten their gardens replanted and had realized that their taro could no longer be relied upon, they

began to search for ways to remedy the problem. Their attempts can be divided into four categories: (1) use of garden magic and traditional *medisen* (2) requests for government assistance (3) relocation of gardens to higher ground (4) continued testing in the hope that the blight would subside or that resistant varieties would be found.

In many areas traditional garden magic was resorted to in attempts to "fight" the new "*sik bilong taro.*" Growth magic was used as well as specific *medisen*(s) which had formerly been used to fight familiar taro diseases and pests. Most of the evidence revealing that traditional ceremonies were used to counteract the taro blight comes from interviews with villagers in 1973. There is however some contemporary evidence which tends to substantiate the findings of the interviews. From a May 1948 patrol to the North Nasioi area, W. J. Kelly reported:

> During the patrol the word '*LUKANU*' or '*DUKANU*' was encountered when any enquiries were made regarding taro. Upon questioning it was found that Lukanu was used in making garden magic, mainly confined to the propagation of taro. It consists of bark scrapings from various trees and plants gathered by one particular man in the village. It can be used in two ways. One way was to place a small portion of the substance in with the taro shoot and cover both with soil. The other being to light a fire on the windward side of the garden area and to burn the bark scrapings in it, thus allowing the smoke to cover the whole area, thus reaching and affecting all plants."[60]

Patrol Officer Kelly emphasized that the people were very concerned with trying to re-establish taro but were not having much success.[61] Interviews in 1973, with residents of the Kongara and South Nasioi Census Divisions, revealed that garden magic similar to that reported by Kelly was engaged in immediately after the war. Residents of Damung (Kongara) and Bakatong (South Nasioi) stated that a coconut shell was

filled with the bark and leaves of various plants together with taro roots. The shell was then stored in the *hauskuk* (cookhouse) and in Bakatong the ingredients were sometimes sprinkled on the taro plants. In both villages the purpose of this preparation was to insure the healthy development of large corms of taro. Although many gardeners used such preparations to fight the taro blight, these attempts were not successful.[62]

In Siwai, some informants described various forms of garden magic (known as *KUNA* in the Siwai language) which were traditionally used against other taro pests and diseases. They stated that some had been tried against the taro blight but they were found not to be strong enough, because the blight had been caused by a foreign *medisen*, with which their traditional *medisen*(s) simply could not cope.[63] In the Buin area, people told of similar kinds of garden magic which had been used before the war. At Pariro Village people even mentioned the use of a coconut shell filled with herbs and kept in the house to insure a good taro crop. They claimed however that they had had no chance to try their traditional *medisen*(s) against the taro blight because of its immediate severe devastation.[64] On Buka a major traditional technique for fighting plant diseases was smoking or *smokim*. Certain plants were burned in the taro garden so that the smoke produced would come into contact with the taro leaves. Residents of Hanahan I said that smoking was used against the blight but was not effective.[65]

Having failed to overcome the effects of the taro blight through traditional methods, some villagers began to inquire about government assistance. The Assistant District Officer for the Kieta Subdistrict,

J. P. White, an enthusiastic supporter of the idea that taro should be re-established, had informed the Nasioi people of agronomist George Harvey's assignment to work on a solution to the taro problem. White wrote in an Aug. 14, 1947 memorandum to the District Officer: "The proposed activities of the Agronomist are being explained and interest in these activities is developing."[66] Less than a year later, W. J. Kelly, in a North Nasici Area Patrol Report, wrote: "...the wilt is still in all the gardens and many enquiries were made regarding the progress towards the cure of this disease, the natives were informed that officers are still working on the solution..."[67] In a May 25, 1949 Patrol Report from the Koromira area, W. I. Westerman, similarly reported: "Many enquiries were received by the writer as to whether the taro pest problem has yet been solved. The natives were informed that every effort is being made to discover the cause of the 'wilt'."[68] In a forwarding letter to the District Officer for Westerman's Patrol Report, ADO D. J. Parrish, stated: "The taro problem is identical with that prevailing almost throughout Bougainville and natives far and wide are eagerly awaiting the solution to the problem by the Agriculture Department."[69] Unfortunately the solution was not forthcoming, but it took many years for the people to realize this fact. In a September, 1952 Patrol Report ADO A. K. Jackson, noted the following query from the Lugakei area of Buin: "The natives have asked whether any form of spray is successful against the wilt and information and assistance in this matter from the Department of Agriculture would be appreciated."[70] But the Department of Agriculture did not respond and as shown earlier, the official view of that Department (in 1954) was that there was no reason why taro could not be superseded by other crops.[71]

In certain areas in the western regions of Bougainville, people reportedly found their own "solution" to the taro blight. B. A. McLarty in an August 1949 Patrol Report from the Keriaka-Kunua-Hahon area stated: "It has been found that native taro will grow well on the higher slopes and this is one of the principal reasons for the recent movement of many of the Keriaka villages higher into the range."[72] In September of the following year Patrol Officer A. K. Jackson gave a similar account from the Kunua area: "...throughout the area patrolled taro crops are still being affected by a blight. The people of Kiakara [village] claim that they have found a solution by establishing their gardens at higher altitudes. It appears that this has received some success and the information was passed on to all other villages."[73] McLarty's above-mentioned report is the only known account of the actual migration of whole villages in response to the taro blight. It is quite likely that when possible, gardens were moved to higher elevations (as reported for Kiakara) in many areas because it has been and is still widely recognized on Bougainville (since the outbreak of the blight), that taro grows much better at higher altitudes. This fact was noted by T. J. Leabeater in a Patrol Report from the Sailo-Teop area in 1952.[74] Also in 1952, but from the Banoni Census District, Patrol Officer J. E. Norton reported:

> Prior to the war taro was successfully grown throughout the Banoni division but since, most crops have failed... Mom village alone has produced good crops, but there is no difference in their method [of cultivation] to those of other natives. Taro has largely replaced sweet potato as the staple...and the taro hungry coastal natives enjoy taro hospitality during visits to Mom. The nearby Kerakopa village has bought tubers from Mom and to date have reared them successfully.[75]

By 1956, Kerakopa had succeeded in growing taro. D. J. Hook, in a May 1956 Banoni Patrol Report stated that, "Mom and Kerakopa are the only villages that have taro as their staple. All other villages have sweet potato." He noted that this was so, even though taro was "still much more popular as a food in this area..."[76] Although not mentioned by either of the two patrol officers, the reason for the success of taro at Mom and Kerakopa is almost certainly their higher elevation relative to the coastal villages.[77] This explanation is backed up by Agricultural Officer K. I. Tomlin's 1956 observations in the Banoni area. Tomlin reported that taro was "not grown to any extent at lower altitudes" because of the blight but that taro was grown "in the higher parts" where the incidence of the blight was "sporadic" and appeared "to vary with weather conditions."[78] Tomlin had reported the previous year from Buin that taro could not be grown "except in isolated spots in the mountains, presumably where sources of infection and temperature are much lower."[79] The above reports, based on firsthand observations, reveal that the severity of the blight was in fact limited by the lower temperatures of higher altitudes, as predicted by the scientific data presented in Chapter II.

Thus, people throughout Bougainville discovered that taro could still be grown at higher elevations. But to those people with no access to higher ground, this discovery had little significance apart from confirming their explanation of the blight--the ground in the mountains had escaped most of the bombing because the war had been fought mainly in low-lying areas. In the low-lying areas taro was continually tested for many years in the hope that the blight would go away or that resistant

varieties would be found. In some areas, these sustained efforts led to at least partial success, but in others there have been nothing but failures right up to the present. The people of the Buin and Siwai language groups began trying to plant taro gardens as soon as planting material was available after the war. In southern Bougainville and in all other areas where planting material was in short supply, people brought taro in from other areas. This undoubtedly helped spread the blight throughout Bougainville-Buka at a much faster rate. According to Patrol Reports, gardens in the low-lying areas of Buin-Siwai were so severely affected by the blight that even the first postwar crops failed. In late 1946, in the Kono area of Buin, it was reported that taro had failed "completely" and "successive plantings" had "died long before maturity."[80] Two years later, ADO D. J. Parrish wrote that the people of the Paubakei area, "after many attempts at replanting taro...have finally given up the idea of this crop ever making good again for some time to come."[81] But even in 1950 many people were still trying. R. R. Cole noted in an October 1950 Patrol Report from the Kono area: "Although repeated attempts have been made and are still being made to re-establish the native taro, efforts to date have met with no success."[82] Patrol Officer B. B. Butcher, in April 1951, noted that in the Lugakei area people, "grew taro more as an experiment" in "small areas approximately 20 x 20 feet."[83] From the same area the following year, ADO A. K. Jackson, recorded that people had been "planting....taro very openly amongst the sweet potato" and thereby reducing to some extent the severity of the blight.[84]

By the early 1960's, despite years of testing and experimenting, the people of the Siwai-Buin region still had found no blight-resistant

or even blight-tolerant varieties of taro. In 1960, Agricultural Officer G. E. Haling, after a patrol to the eastern Siwai area, wrote:

> Original native taro...is almost extinct in this area, only 2 small gardens were noticed. Immediately post war the disease *Phytophthora colocasiae* swept the area, eliminating *Colocasia* varieties. No disease-resistant strains were noticed.[85]

Agricultural Officer M. L. Jones reported a similar situation from Western Siwai in 1962.[86] In the same year, after a patrol to the Orava area of S.E. Buin, Jones wrote the following concerning *P. colocasiae*:

> This disease attacks Taro *colocasia* in all places in the area. It comes in cycles which from enquiry appear related to the incidence of rain and subsequent humidity. No partially resistant types were seen or reported.[87]

In 1973, a few people in the Buin-Siwai region were still experimenting with small numbers of taro plants here and there. In Siwai, interviews indicated that people had tried planting taro under the eaves of their houses to lessen the blight's severity, but without much success.[88] At Mabis Village in Banoni and at Moro Village in Buin, examples of such plantings were seen but the villagers in both cases stated that these plantings would be severely damaged (by the blight) during the next heavy rains. At Moro, it was learned that an old woman had made the plantings after purchasing the taro from mountain dwellers at the Buin market.[89] Although to this day no blight-resistant nor blight-tolerant varieties have been reported in Buin-Siwai, the people continue the search. An interview at Pariro Village in Buin revealed that some planting material from Buka had recently been imported, but that it too had failed to withstand the blight in Buin.[90] When asked

why this taro grew better on Buka, the villagers responded that there had been less bombing and fighting on Buka than at Buin.[91]

Although there had been less fighting on Buka, the number of Japanese occupying the island was great enough to cause hardship in itself. As earlier noted, by the close of the war, because of the hungry Japanese, there was very little taro left on Buka. Archer wrote in early 1946 "There are NO taro gardens in the area, excepting for a few carefully guarded 'nurseries' from which it is hoped later to obtain 'tops' for replanting."[92] The process of multiplying the available taro was made all the more difficult by the presence of the blight. Father John Keady, who arrived at Gagan in 1947, remembered that because of the blight, only a few taro plants out of an entire garden would survive. These surviving plants would then be replanted and multiplied. The Gagan people told Father Keady, that they were looking for some "*strongpela taro*." He said that they had shown "remarkable tenacity" in these attempts to re-establish their taro.[93] By 1948, according to a DASF patrol report, most gardens along the east and northwest coasts contained small areas of taro, except at Tandeki Village where the people had given it up altogether. However, the report stated, "...in all cases signs of the disease *Phytophthora colocasiae* were visible in varying degrees of severity."[94] In April of 1949, patrol officer B. A. McLarty reported that in the Solos speaking areas of Buka, "taro crops have repeatedly failed..." and that sweet potato had become the staple food.[95]

Agricultural Officer Gordan Wilson, visited a number of Buka villages in November of 1949. He reported that while the situation

with regard to taro had not changed much during the past year, some progress was being made:

> All taro seen was affected by *Phytophthora* but by a process of natural selection the more tolerant varieties are becoming more evident and these do reach maturity although the yield is usually low. As a result taro is again an article of diet, although a minor one, in some villages...[96]

After inspecting gardens at Kohina, Hapan, Gagan and Nova in the Solos speaking section of Buka, A. K. Jackson wrote the following in June of 1950: "Throughout this area the taro crop is being affected by a blight, however the people are persevering and have achieved some success with a hardier variety of taro which they purchase at a very high price from natives of Halia sub-division..."[97]

By the early 1950's, then, some more or less blight-tolerant varieties of taro had been found. However from the end of 1951 through 1954, during his stay on Buka, DASF Regional Controller, Eric Wilson, recalled that even though certain varieties reached maturity, the yield obtainable was still not sufficient to permit the re-establishment of taro as the staple.[98] In early 1956, Agricultural Officer M. J. Mead, after a patrol of Buka, wrote, "The basic food of the Buka Island people is sweet potato...it is noted however that taro is again being planted in larger proportion and being attacked only mildly by the disease."[99] Later in the year in another Buka patrol report, Mead wrote:

> Taro is still increasing in popularity as a food crop but as more extensive gardens are planted so the disease *Phytophthora colocasiae* seems to be more damaging. Sweet potato is still the basic food but when taro is bearing well it is eaten almost solely as the basic food.[100]

In the early 1960's, seven clones of Buka taro were tested for blight resistance at the Lowlands Agricultural Experiment Station at Keravat on New Britain. Of the seven, only the clone "Seeru" from Lemankea village was found to be moderately resistant; the remaining six were only weakly resistant. The resistance levels assigned to the seven clones were only relative, based on the number of blight-free leaves on a highly susceptable New Britain clone.[101] Interviews with Buka villagers made in 1973, confirmed that of the varieties now grown, none is totally resistant to the blight. However the villagers said that the variety known as Siru is only the second most resistant variety. At Lemanmanu, Hanahan I, and Ieta, all in the Halia language area, those interviewed maintained that Bibil was the most blight-resistant and abundant variety, while Siru was second to Bibil. At Gagan, in the Solos language area, Bibil is known as Bubuin and Siru as Sin, but the people interviewed agreed that Bubuin (Bibil) was the most resistant variety they possessed.[102]

Although there are no available figures showing the relative levels of consumption for taro vs. sweet potato on Buka today, the 1973 interviews indicated that throughout the island sweet potato is eaten more often than taro. Furthermore the interviews revealed that the varieties of taro now eaten were considered to be among the less desirable varieties grown before the war.[103] The favorite varieties were lost either during the war or because of the blight.

In the low-lying areas from Buka Passage down the east coast of Bougainville to the Buin Sub-district boundary, the attempts to re-establish taro after the war were not as successful as those on Buka,

nor as unsuccessful as those in Buin-Siwai. As in other areas there was a shortage of planting material during the period of readjustment and rehabilitation following the end of the war. At the end of 1946 C. W. Slattery reported from the Sailo-Teop area that the gardens of the hill people contained taro but that at least half of it was infected with the "prevailing disease." The coastal villages needed "taro shoots" for planting and it was hoped that some would soon arrive from New Britain.[104] By mid-1948 the coastal villages had been able to plant taro but it suffered severely from the blight.[105] A 1952 patrol report noted that because of the continuing severity of the blight the coastal villages had switched to sweet potato as the main crop. The report also noted that inland gardens were less affected by the blight while mountain gardens were "free entirely."[106] Taro continued to be planted but a 1955 patrol stated that the coastal villages still were producing very little.[107]

Apparently the situation in the Teop-Sailo area has changed very little right up to the present.[108] Kirk Shoffner reports from Teop that along the coast taro is grown, but to quite a limited extent. He says that taro constitutes a very low percentage of the starch intake for the coastal people, and that much of the taro that is consumed comes from the mountains by way of trade with the mountain people.[109]

In the Aita census division south of Teop, the story is very similar except that for some reason the people of this area relied more on kong kong taro (*Xanthosoma* spp.) as a substitute for *tru* taro.[110] But they too were very diligent in their endeavors to re-establish their prewar staple. A 1950 patrol report stated: "The

natives claimed that they had not had a disease-free [taro] crop since the war but persist in their efforts with the hope of eventually obtaining a resistant variety."[111] Patrol reports from the early 1950's show that they were apparently unsuccessful for they continued to rely on kong kong taro.[112]

In the Rotokas Census Division and in the low-lying areas surrounding Kieta, sweet potato became the staple during the postwar years but as in other areas taro was continually tested in the hope that eventually it could be reinstituted as the staple.[113] In 1956, Agriculture Officer D. W. Macaulay reported that in the Kieta region it was "still not possible to grow taro in the lower areas owing to the taro-wilt (*Phytophthora colocasiae*)."[114] However by 1959, Agriculture Officer G. J. Harvey in discussing the blight in South Nasioi wrote: "A definite development of resistance to the disease by most of the varieties has been reported."[115] But Harvey only mentioned observing such resistance in gardens planted above 2000 feet.[116]

In 1973, the people of Tourepera village, on the coast between Kieta and Aropa, stated that they had some partially resistant taro (it gets the blight but usually does not die). But they emphasized that the situation was not the same as before the war. They now only ate taro some of the time, relying on sweet potato as their main food.[117] Interviews with Aropa Valley residents revealed a similar situation, although some Aropa people have their gardens at elevations up to 2000 feet and given favorable weather conditions do produce a certain amount of taro. Nevertheless, sweet potato remains their staple food.[118]

Generally speaking the response to the taro blight by the people of Bougainville-Buka does not detract from their reputation as skilled

horticulturalists. Their explanation that the blight was caused by some "*medisen bilong bom*" is not at all unreasonable given their lack of knowledge concerning disease-causing fungi. It should be recalled that the true cause of the Irish Potato Blight of the 1840's was not clearly understood until the 1870's.[119] As earlier noted, some Bougainvillians believed that the blight lesions on the taro leaves were caused by volcanic ash settling on the taro at night. W. H. McNeill, in writing about the Irish Potato Blight, reported that in Britain, in 1847, "A medical doctor stated that the blight was due to volcanic action upsetting the balance of the atmosphere..."[120] In the 1973 interviews representing ten census divisions, there was no recollection of any taro disease ever having been as devastating as the taro blight. Informants could only cite too much rain (flooding) and too much sun (drought) as causes of past taro failures. In all ten census divisions, people identified and named other taro diseases and pests but in no case did they attribute to them the destructiveness of the taro blight. All areas identified the taro beetle and what appears to be a virus disease of taro (leaves crinkled and feathering between veins) as ancient problems--the ancestors also had them. There were remedies or *medisen* for most, if not all, the familiar taro pests and diseases. These remedies varied from family to family and village to village but often involved the burning of leaves, bark, or roots in the taro garden. Some procedures insured that the taro would grow well in the face of all problems but other *medisen*(s) were for specific diseases. One Siwai man, the son of a kind of traditional *didiman* (agricultural extension agent), named and described three taro diseases

and an insect pest, and related his father's remedies for each.[121] Some of the procedures described were obviously ceremonial or magical in nature but others utilized the juice of certain crushed plants and water from green coconuts and involved the removal and destruction of discolored or crinked leaves. Two of the diseases had virus-like symptoms, the other was a kind of rot, and the insect was the taro beetle (*Papuana* spp.). Whether or not these traditional remedies had any scientific merit is not known, but the important thing is that the established pests and diseases had traditionally been kept in check. The established diseases had never affected an entire garden as the blight does--most informants agreed that only a few plants out of a garden would be infected with a particular disease at a particular time. When the rapid devastation of the taro blight arrived abruptly after the war, what were they to think? Most informants stated that they had tried their traditional *medisen* against the blight but it had failed. Many have concluded that since the disease was caused by a European *medisen,* only a European *medisen* can stop it. Indeed, during the interviews the people often asked for *medisen* for their taro--they assumed that surely some "*medisen bilong Amerika*" could have been supplied to cure their sick taro. Although still cooperative, they were often a little disappointed that all that was wanted, was to record the *stori* of the "*sik bilong taro*."

The response of the people of Bougainville-Buka to the taro blight was as adequate as could be expected, short of the frequent (but prohibitively costly) application of fungicides. The people of Kunua and Keriaka quickly learned that the blight was less severe at higher

elevations. The Buka people, having no mountains to move into, immediately took up the search for some *strongpela* taro. While neither they nor anyone else has yet discovered a totally blight-resistant or immune variety, they did succeed in isolating some which are semi-resistant or tolerant. Unfortunately the people of Buin and Siwai had very little success in their endeavors to combat the blight. But there was little they could do in the face of the almost year-round blight-favoring climatic conditions which occur in their region. In the end, the assumption that this foreign disease requires a foreign solution may prove to be correct.

Chapter III Notes

1 F. P. Archer, Buka Patrol Report, February 14, 1946, PNG NA, Bougainville District PR, 1943-46.

2 Capt. Slattery, Nagovisi Patrol Report, July 24, 1945, PNG NA, Bougainville PR, 1943-46.

3 E.g., some Konga villagers in Siwai stated this in a November 19, 1973 interview.

4 Gavin Long, *The Final Campaigns* (Canberra: Australian War Memorial, 1963), p. 92.

5 *Ibid.*, p. 103.

6 U.S. Army, Far East Command, Japanese Monographs #127, S. E. Area Operations Record Part IV 8th Army Operations, p. 179.

7 Gavin Long, p. 103.

8 23rd Brigade (Australian Army), "History of the Japanese Occupation of Bougainville, March 1942-August 1945," as quoted by Gavin Long, *The Final Campaigns*, pp. 113-114.

9 These conclusions were drawn from a reading of Gavin Long's *The Final Campaigns*.

10 Gavin Long, p. 136.

11 See Bougainville District Patrol Reports, 1943-46, PNG NA.

12 R. C. Cambridge, Kunua-Hahon Patrol Report, Oct. 4, 1945, PNG NA, Bougainville District PR, 1943-46.

13 The problem may have been the interviewer's inability to ask the right questions or some other communications barrier resulting from cultural and linguistic differences.

14 F. P. Archer, Buka Patrol Report, February 14, 1946, PNG NA, Bougainville District PR, 1943-46.

15 Minute, Act. Gov. Sect. to Act. Admin., April 28, 1947, PNG NA, DASF File 1-1-29, Part 1.

16 R. R. Cole, Buin Patrol Report, March 15, 1947, PNG NA, Bougainville District PR, 1946-48.

17 J. P. White memo to C. W. Slattery, August 14, 1947, DASF CPP, F21-4-3.

18 PNG NA, Bougainville District PR, 1946-48. True taro, in Pidgin, *taro tru,* refers only to cultivated *Colocasia,* excluding wild *Colocasia.*

19 Personal communication to author.

20 *Ibid.*

21 *Ibid.*

22 F. P. Archer, Buka Patrol Report, February 14, 1946.

23 *Ibid.*

24 Director of Native Affairs to Director of Agriculture, October 16, 1946, Div. of District Admin., Konedobu, File 6-4-11.

25 Rev. A. H. Voyce, personal communication to author.

26 Personal communication to author from both men.

27 E.g. see J. G. MacKay, Keriaka Patrol Report, October 3, 1945 and R. C. Cambridge, Kunua-Hahon Patrol Report October 4, 1945, PNG NA, Bougainville District PR, 1943-46.

28 Personal communication to author.

29 November 1949, PNG NA, DASF Reports-Monthly, Div. of Ag. Ext. Bougainville District. The idea that sweet potato is nutritionally superior to taro is doubtful. It is discussed in Chapter 4.

30 Prof. Peter Pirie, Dept. of Geography, UH, personal communication to author.

31 E. E. Trujillo, personal communication to author.

32 E. Ogan, *Business and Cargo* (Canberra: New Guinea Research Unit, 1972), p. 76.

33 Buka Patrol Report, February 14, 1946.

34 Report No. 2 of 1950/51, PNG NA, Buin PR, 1950-53.

35 J. Young-Whitford, Patrol #2 of 48/49, August, 1948, PNG NA, Bougainville PR, 1948-49.

36 Buin Patrol Report, November 15, 1960, DASF Bougainville District Office, File 32-1C.

37 Boku Patrol Report, No. 2 of 1955/56, May 16, 1956, Dept. of District Admin., Buin Office, File 30/2.

38 Personal communication to author.

39 Personal communication to author.

40 Interview with Chanel Sagoh, Councilor, and others at Gagan, December 17, 1973.

41 *Ibid.*

42 E.g., Rovai Karankeu, Interview at Lamaponto Village (behind Arawa), December 28, 1973. Rovai is the highly decorated guerrilla fighter who fought with Paul Mason during the war.

43 Interview with several Tourepera villagers, December 28, 1973.

44 Interview with Daisi of Hari Village, Siwai, November 23, 1973.

45 Interview with Daniel Kauma of Panakei Village, November 27, 1973.

46 Interview with a woman from Pariro Village, December 5, 1973.

47 Interview with Andreas Umim, December 5, 1973.

48 Interview, December 4, 1973.

49 Interviews with people from Parie Village and Boskombu Village on December 12, 1973 and December 14, 1974, respectively. Also Kirk Shoffner, personal communication to author.

50 Interview, December 12, 1973.

51 Interview with Siara Village's headman, Kerol, December 15, 1973.

52 Interviews with various residents, December 20 and 22, 1973.

53 Interviews at Hanahan I, December 17 and 19, 1973.

54 Interviews with Titus Lagolo, Augustan Soli, and Karari at Lemanmanu, December 21, 1973.

55 Sherrod cites, *ComAirSols Strike Command war diary*, Part V (statistics) for the source of his information on the spraying of gardens.

56 Reports of Flights, PNG NA, Boug. Dist. PR, 1943-46.

57 Robert Sherrod, p. 155.

58 Interviews in Konga and neighboring Siwai villages, November 19-27, 1973.

59 Interview, November 29, 1973.

60 Patrol Report 5 of 47/48, PNG NA, Boug. Dist. PR, 1946-48.

61 *Ibid.*

62 Interviews at Damung and Bakatong on November 17, 1973 and November 14, 1973, respectively.

63 Interview with a *mumi* (big man) of Kinilui Village, November 24, 1973. Other interviews in Siwai yielded similar information.

64 Interview with Simpa and others from Pariro Village, December 4, 1973.

65 Interviews with Tagira Kenehe and Hulul on December 17, 1973 and December 19, 1973, respectively.

66 DASF CPP, F 21-4-3.

67 See note 57, above.

68 PNG NA, Bougainville PR, 1948-1949. In fact, the cause of the wilt was already known by this time.

69 *Ibid.*

70 PNG NA, Buin PR, 1950-1953.

71 See Henderson's reply to Father Fingleton's complaint that nothing had been done to re-establish taro, as earlier quoted, Chapter I, p. 31.

72 PNG NA, Buin and Kieta PR, 1949-1951.

73 Kunua and Hahon Patrol Report, PNG NA, Sohano PR, 1950-1953.

74 Sailo/Teop Patrol Report, No. 1 of 52/53, PNG NA, Sohano PR, 1950-53.

75 Banoni Patrol Report, No. B.N. 3 of 52/53, PNG NA, Buin PR, 1950-1953.

76 See note 34 above.

77 In a September 12, 1945 Patrol Report from the Atamo-Kerakopa area, Capt. Boisen stated that Mom was situated atop a "500 feet feature" while Kerakopa was located atop a "2500 feet feature," PNG NA, Bougainville PR, 1943-46. Gardens are often located even higher than the villages.

78 Ag. Report No. 1, 1956-57, Buin Sub-District, November 27, 1956, PNG NA, Reports Patrol Division Ag. Ext. Sta., Bougainville District.

79 Buin Subdistrict Ag. Patrol Report, October 26, 1955 PNG NA, Reports Patrol Div. Ag. Ext. Sta., Bougainville District.

80 A. J. Humphries, Buin Patrol Report, January 6, 1947, PNG NA, Bougainville District PR, 1946-48.

81 Paubakei Paramountcy Patrol Report, January, 1949, PNG NA, Bougainville PR, 1948-49.

82 PNG NA, Buin PR, 1950-1953.

83 Luaka (Sic) Paramountcy Patrol Report, April, 1951, PNG NA, Buin PR, 1950-53.

84 September 1952, PNG NA, Buin PR, 1950-53.

85 Patrol Report, Eastern Div., Siwai Ling. Group, January 20, 1960, DASF District Office, Kieta, File 32-8.

86 March 19, 1972, DASF Dist. Office, Kieta, File 32-1-C(3).

87 Buin Patrol Report, Orawa Area, December 5, 1961, DASF District Office, Kieta, File 32-1-C.

88 Interview with John Peniai and others at Konga Village, Siwai, November 19, 1973.

89 Interview at Moro (Father John Momis' village), December 3, 1973.

90 Interview, December 4, 1973.

91 *Ibid.*

92 F. P. Archer, Buka Patrol Report, February 14, 1946, PNG NA, Bougainville District PR, 1943-46.

93 Father John Keady, Interview at Turiboiru Mission, December 1, 1973.

94 Report on Inspection of Native Gardens on the East and Northwest Coast of Buka Island, February 1948, PNG NA, Reports Patrol Div. Ag. Ext. Sta., Bougainville District.

95 Patrol Report No. 7 of 1948/49, PNG NA, Bougainville PR, 1948-49.

96 Monthly Report, November 1948, PNG NA, DASF Reports-Monthly, Div. of Ag. Ext., Bougainville.

97 Patrol Report No. 10 of 49/50, PNG NA, Buin and Kieta PR, 1949-51.

98 Interview at Rabaul, October 15, 1973. Eric is the brother of Gordan Wilson.

99 Buka Patrol Report, January 28, 1956, PNG NA, Reports Patrol Div. Ag., Ext., Bougainville District.

100 June 26, 1956, PNG NA, Reports Patrol Div., Ag. Ext. Sta., Bougainville District.

101 P. G. Hicks, "Resistance of *Colocasia esculenta* to Leaf Blight Caused by *Phytophthora colocasiae*," *png Agric. J.*, 19, No. 1 (July, 1967).

102 Interviews at the above-mentioned villages were conducted during December 17-22, 1973.

103 Interview with District Commissioner, Alexis Serei, of Gagan Village, December 10, 1973.

104 C. W. Slattery, Buka Passage-Teopasino Patrol Report, January 20, 1947, PNG NA, Bougainville District PR, 1946-48.

105 J. Young-Whitford, Sailo-Teop Patrol Report, August, 1948, PNG NA, Bougainville PR, 1948-49.

106 T. J. Leabeater, Sailo/Teop Patrol Report, July 1952, PNG NA, Sohano PR, 1950-53.

107 M. J. Mead, Ag. Patrol of Kunua, Hahon, Keriaka, Sailo, Teop, December 20, 1955, PNG NA, Reports Patrol Div. Ag. Ext. Sta., Bougainville District.

108 Interview with Kerol of Siara village, December 15, 1973.

109 Personal communication to author. Shoffner is engaged in anthropoligical research in Teop (1973-74).

110 W. J. Kelly, Aita Patrol Report, March 1949, PNG NA, Bougainville District PR, 1946-48.

111 R. R. Cole, Aita Patrol Report, June 1950, PNG NA, Buin and Kieta PR, 1949-51.

112 J. H. Coghlan, Aita Patrol Report, March, 1951, PNG NA, Buin and Kieta PR, 1949-51.

113 A. C. Jefferies, Rotokas Patrol Report, June, 1947, PNG NA, Bougainville District PR, 1946-48.

114 Ag. Patrol Report, September 17, 1956, PNG NA, Reports Patrol Div. Ag. Ext. Sta., Bougainville District.

115 Ag. Patrol Report, February 12, 1959, Kieta DASF Office, File 32-2-4.

116 *Ibid.*

117 Interview, December 28, 1973.

118 Aropa Valley Interviews were conducted during November of 1973.

119 W. H. McNeill, "The Influence of the Potato on Irish History" (Ph.D. Thesis, Cornell University, 1947), p. 240.

120 *Ibid.*

121 Interview at Panakei Village, November 27, 1973.

CHAPTER IV

Some Taro Blight-related Changes on Bougainville-Buka

The introduction of the fungus, *Phytophothora colocasiae,* into Bougainville-Buka resulted in important changes in the lives of a large proportion of the indigenous population. These changes can be broken down into (1) those stemming from the loss or diminished reliability of taro as the staple crop and (2) those resulting from the substitution of sweet potato as the new staple crop. The former changes will be discussed first.

The movement of villages and gardens to higher elevations in Keriaka and Kunua as a response to the taro blight was discussed in Chapter III. It is not known whether or not these movements were permanent, since no interviews were conducted in these areas during 1973. There is however some evidence that at least many of the gardens in the Keriaka Census Division remain at higher elevations. From information gathered during the 1966 census, David Lea found the Keriaka Census Division to be the only area of Bougainville-Buka in which "taro" has remained the most important food.[1] Lea's category "taro" includes *Xanthosoma* spp. as well as *Colocasia esculenta*, but in view of earlier postwar reports (from the 1950's) it is likely that *Colocasia* remains the more important of the two types. If taro is in fact still the most important food in Keriaka, the implication is that since the blight continues to adversely affect lowland cultivation, the gardens, if not the villages, must still be situated at higher elevations.

The coincidence of the spread of the taro blight throughout Bougainville-Buka with World War II makes it difficult to attribute

any given change solely to the effects of the blight. For example, the trade or barter involving (among other things) taro and fish which had traditionally taken place in many parts of Bougainville-Buka was first interrupted by the war but then hampered by the blight-related scarcity of taro. The British anthropologist, Beatrice Blackwood, described in detail the exchange of fish by the people of the Petats and Saposa Island groups for taro from the inland dwelling villagers of Buka and Northern Bougainville as it occured in 1929-30.[2] She wrote, "The fish-taro exchange is a permanent feature in the life of all the villages in this area."[3] Unfortunately it was not as "permanent" as she had assumed. Fred Archer reported in 1946 that the barter between the islands west of Buka and the Buka mainland had not "been recommenced since the hostilities ceased," because the islands' fishermen lacked the necessary fishing equipment such as lines, hooks, and nets.[4] Today Archer recalls that due to the scarcity of taro the traditional bartering system was never resumed in its prewar fashion.[5] Nowadays there is a twice-weekly market at Chinatown on Buka Passage where taro and fish are sold, but apparently mainly on a cash basis. Interviews at Lemanmanu revealed that the long-established exchanging of taro from Northern Buka for pigs from Nissan ceased after the war.[6] Ogan noted that fish-taro exchanges in the Aropa Valley area between coastal and inland peoples also ceased after the war.[7]

The decline of traditional bartering involving taro might have taken place without the occurrence of the blight. The increased use of Australian money together with the disrupting influence of the war might have yielded the same results. However the adoption of sweet potato as

the substitute for taro undoubtedly was one factor in the decline of bartering, for groups with land unsuitable for taro might well be able to grow sweet potato and therefore get by without exchanging their fish.[8] This seems to have been the case along the coast in the Teop area, although as previously noted, the Teop people are again exchanging fish for taro on a limited scale.[9]

The loss of taro as the most important crop in most areas of Bougainville-Buka was a serious blow culturally. There were at least two aspects to the cultural importance of taro. One was the culturally derived personal preference for the taste, texture, appearance, and what might be termed the "satiating quality" of taro (after eating taro one does not feel hungry, say taro-eaters). The other aspect was the importance and emphasis which cultural values placed on cultivating, exchanging, and consuming taro. During and after the war when the people of Bougainville and Buka were first deprived of taro, their immediate reaction must have been a sense of personal disappointment. Taro had been their favorite food, indeed the only food which really filled them up and kept them strong. It had long been considered a basic necessity. Their sense of loss and accompanying disillusionment, as recorded by Europeans who witnessed it, have already been considered in Chapter III. However, the mystique surrounding this food, with all the popular notions regarding its strength-giving qualities needs to be emphasized. Long-time Buka resident, Fred Archer, expresses the popular pre-war beliefs about taro which apparently were even held by Europeans:

> ...it was the staple article of diet with the natives and was supposed (by many "experts") to have all necessary ingredients to supply all vitamins--plus energy--to the person who consumed taro. It was a much prized

> article of diet and what could be done by a native on a few taros--cooked in the ashes and carried in a basket--on arm or by hand--was astonishing--long journeys done by road and hard work--with a drink of water from a stream or a kulau (drinking nut) from a palm.[10]

Among the Siwai, in 1938-39, Oliver noted that other starch foods were considered to be second best, "most adults insisting that taro alone gives them the feeling of stuffed satiation which should accompany every satisfactory meal."[11] From Buka and Northern Bougainville, Blackwood observed in 1929-30, that taro was the staple and stated, "no meal, whatever else is included, is complete without it, and it will, if necessity arises, suffice for a meal by itself."[12] In the interviews conducted in 1973, most older people who remembered when taro was the most important food still prefer it over all others, stating that it makes them feel strong and fills them up more than sweet potato. The younger people, however, seemed not to have any special preference for taro, having been reared mainly on sweet potato (except in the mountains where taro is eaten more often and probably preferred by everyone).

The idea that eating taro gives one the feeling of "stuffed satiation" like no other starch food appears to be widespread among those people who are reared on taro as the staple food. The present-day inhabitants of Western Samoa are such a people and have very strong feelings about the superiority of taro over all other starchy foods. They say that taro is the food which provides the greatest feeling of satiation (*'E sili atu le talo 'e ma'ona lelei ai*).[13] Among the Maenge of East New Britain (about 225 miles due west of Northern Bougainville), there is the belief that taro has a soul and that, "The presence of soul in edible plants...makes them heavy..."[14] If taro is cultivated

properly, using the appropriate type of magic, the corm of the taro will be "big and heavy." "When such a density of soul is obtained, to eat only a very small piece of corm is enough to satisfy one completely."[15]

In the ethnographic literature from Bougainville-Buka there are no known reports of taro possessing a soul. However, it should be recalled that in Siwai, the explanation given for the postwar failure of taro, but not sweet potato, was that taro was more like a man and could feel sick from the wartime *medisen* which had poisoned the ground. Also Beatrice Blackwood mentioned that at Kurtatchi Village in Northern Bougainville, "special kinds of taro with red stalks,...extra fine varieties," were planted in a strategic way so that they could, "talk to the ordinary taro saying: 'We must grow quickly...'".[16] Further research could reveal that possession of a soul may be yet another human-like characteristic attributed to taro by some inhabitants of Bougainville-Buka.

While not all the cultural groups on Bougainville-Buka can be assumed to have had identical values regarding the cultural significance of taro, all groups did regard it very highly and expended much energy in cultivating it or in obtaining goods which could be exchanged for taro. Garden magic and special ceremonies were usually associated with its cultivation and it played an important role in other rituals and celebrations. Oliver gave the following elucidatory account of the prewar importance of taro among the Siwai people:

> Taro occupies so prominent a place in Siwai life that one might appropriately go on for pages describing the numerous varieties grown; the exact details of planting, weeding, and harvesting; the high value placed upon it as the vegetable food; the feelings of deprivation natives express when they must go without it;

> the frequency with which it enters into conversation; the numerous metaphors for it and its use in ritual; etc...rather than burden the reader with a long technical account, however justified that may be by the importance of the topic, I merely ask him to remember that Siuai natives spend more hours growing taro than in any other enterprise, that the plant comprises 80 percent of their diet, and that it is the basis of their subsistence economy generally. If that is forgotten during consideration of more dramatic activities, then true perspective on Siuai life will have been lost.[17]

Oliver recorded, among others, the following ritualistic or symbolic uses of taro by the Siuai: whole taro plants were used symbolically in baptism ceremonies for infants;[18] taro was not eaten by mourners during the formal period of mourning for a deceased person;[19] whole taro plants from the garden of the deceased were hung on a special railing next to the funeral pyre;[20] taro from the deceased's garden was cooked and placed on the cremation ashes for consumption by the ghost of the deceased.[21] In addition taro was served at most feasts, usually in the form of steamed portions served on a platter, but often also in a much-esteemed coconut-taro pudding.[22]

Similar uses of taro were recorded by Blackwood for Northern Bougainville and Buka and it is likely that such uses were widespread in Bougainville-Buka. The Aropa Valley Nasioi had a practice, known as *ungumo* in their tongue, which involved a tabu on taro-eating by certain kin of a recently deceased person. A section of a type of vine was worn as an armband around the upper arm to show that an individual could not eat taro until the appropriate feast was held removing the tabu.[23] But today the practice has been discontinued, the people say, because it is now no special hardship to go without taro, since it is only available occasionally anyway.[24] Taro puddings were favorites in many if

not most sections of Bougainville-Buka. They are still made occasionally in the Aropa Valley for such special events as growing up feasts.[25] However in Buin and Siwai feast day puddings must now be made of sago or tapioca, because due to the blight, sufficient amounts of taro are simply unobtainable. Not even the higher elevation villages have enough to sell.[26]

Because taro was so important ceremonially and because people were so attached to its special qualities as a satisfying food, much emphasis was given to its proper cultivation. To insure a good crop, especially one that was better than the crop of one's neighbors, many types of garden magic and special ceremonies were relied upon. The fact that both Blackwood and Oliver, writing on two geographically, linguistically, and culturally distinct groups, reported the association of taro with ritual and garden magic suggests that similar associations must have existed in most areas of Bougainville-Buka.

At Siwai, Oliver found that garden magic was not practiced by all households. Many men however did utilize mixtures of magical ingredients especially developed and passed on with specific varieties of taro. Before a new garden was planted, a "consecrated decorative shrub" was planted in a special corner of the garden and then annointed with the mixture of magical materials, thus insuring that the taro to be planted would be "large and healthy, and able to survive drought or destructive magic."[27] Those not possessing magic or good varieties of taro could and did purchase the taro alone or the taro plus the magic from those willing to sell.[28] Blackwood found that the people of Kurtatchi Village (N. Bougainville) had a host of specific "medicines"

for specific problems. There were a number of plant scrappings and/or roots which were chewed with the betel mixture (Areca, lime, and betel pepper) and applied to taro stalks at planting to insure the production of large healthy taro corms.[29] Specially prepared twigs buried on the garden path kept out intruding pigs and special stones were placed in the garden to make the taro grow strong.[30] Gardens planted for specific feasts received very specialized treatment. Blackwood described the lengthy planting ceremony which included such things as: the burning of special leaves which caused thick smoke to settle over the ground to blind unwanted intruders (ghosts and pigs); the planting of special decorative shrubs such as *Cordyline* to make the taro grow well; and the application of a magical mixture of secret plants and minerals to all planting material, digging poles, and to the hands of the women planters, to insure the success of the garden.[31]

The Nasioi of Aropa Valley and Kongara made a magical mixture of plant materials, taro roots and sometimes a certain kind of orange stone, which they kept inside their houses in a special coconut shell. When a new garden was planted, some roots of the new planting material were added to the mixture. In Aropa Valley the mixture was sprinkled on the new taro plants to make them grow large corms. At Kongara, the orange stone was placed at the bottom of the coconut shell containing the mixture and stored in the gardener's house. After a specified period, if the orange stone rose to the top of the mixture it meant that the garden would produce a good crop of taro.[32] Such coconut shell containers can still be found at Kongara.

Neither Blackwood nor Oliver mentioned any garden magic developed for specific pests and diseases of taro. However, interviews in 1973

showed that in every area visited, specific *medisen*(s) had been used against specific taro pests and diseases. In Siwai, one older *mumi* (bigman or leader) mentioned a *medisen* for a taro disease which causes the corm to become rotten. He said that in his family, they placed a leaf of a "*taro bilong bus*" (wild self-propagating *Colocasia*) under the base of the taro stalk when it was planted in its hole. Because this wild variety of taro is very hardy and strong (although having inedible corms), his family had reasoned that this strength would be passed on to the domesticated taro.[33] In Aropa Valley leaves of various plants are used in the same manner to insure a good taro crop.[34] At Pariro Village in Buin, an elongated type of coconut shell painted red and filled with magical herbs was kept in the house (similar to the Nasioi practice) to protect taro from being eaten by *Papuana* beetles.[35] In all of the six linguistic areas visited in 1973, when informants were shown photographs of taro leaves showing virus-like symptoms (feathering and/or crinkling of the leaves), they claimed to be familiar with at least one taro disease with similar symptoms and further claimed to possess specific *medisen* or other procedures for dealing with it. Similar claims were made concerning *Papuana* beetles. Some informants in Kongara displayed taro with a disease which made the corms so hard that only pigs could eat them. In most areas familiarity with corm rot diseases was claimed; some treatments were related. But in no case was there claimed a *medisen* for the blight.

Now that the traditional importance of taro and its successful cultivation in Bougainville-Buka has been examined, what can be said about the changes which occurred as a result of its demise as the staple

food? Certainly the decline of ceremony and magic associated with taro must have influenced changes in other traditional ways of doing things. Eric Wilson, the Agricultural Officer who was stationed on Buka in the early 1950's, recalls that older men especially in the Hanahan area, tried to re-establish taro as a means of reasserting themselves and the "old ways" which were suffering because of the disruption and social disorganization following the war.[36] The wartime loss of many taro varieties and their associated growth magic (which had been passed on for generations), along with the total failure of traditional garden magic in the face of the devastation of the taro blight, undoubtedly undermined the confidence people had in traditional modes of behavior. But before assessing these changes any further, it is necessary to consider the changes resulting from the adoption of sweet potato as the new staple. For these changes are interrelated and overlap with the changes resulting from the forced abandonment of taro.

An important change due to the adoption of a foreign crop such as sweet potato, as the staple, was that, generally speaking, garden magic was not widely used in its cultivation nor did it figure in other ceremonies as had taro. However, Oliver states that in Siwai, the same principles of magic which were employed for the protection and growth of taro were also used for other crops including sweet potato, although "not used as frequently as for taro."[37] Blackwood found only a single example of magic used in sweet potato cultivation. A Petats Island man brought her a large stone which he had formerly placed in his sweet potato garden to make the tubers grow large and palatable, but which he no longer wanted, "having come under missionary influence."[38] The use

of such magic for sweet potatoes must have been rare, for in no case during the 1973 interviews did any informant respond in the affirmative when asked about *medisen* for sweet potato. Indeed, at Siwai, two reasons were given why no *medisen* or ceremonies were used for sweet potato: one, sweet potato grows so easily that no *medisen* of ceremonies are required;[39] and two, no ceremonies or magic exist for sweet potato because it originated in a foreign place, having been brought to Siwai in relatively "recent" times.[40] At Aropa Valley the same two reasons were given in similar responses to the same question.[41] If garden magic and ritual had been frequently associated with the cultivation of sweet potato in Bougainville-Buka, such a situation would constitute a stark exception to practices in neighboring regions. In fact, A. J. Kimber, after compiling data on the cultivation of sweet potato from 60 localities throughout Papua New Guinea, stated:

> The survey has shown that as a general rule, there is no ritual associated with the cultivation or consumption of sweet potato, a feature which contrasts with other subsistence crops such as yams or taro.[42]

Thus, the new reliance on sweet potato, an exotic crop, without established ritual associated with it, caused gardening in postwar Bougainville-Buka to lack the traditional more magical and mystical aura which once surrounded it. To people so accustomed to the use of ritual and magic, this change must have taken some of the satisfaction and excitement (destructive garden magic was also employed by one's enemies) out of subsistence gardening. In evaluating this event, the possible strong attachment to the ritual or even mystical qualities of taro should not be underestimated. Either due to the crop's great

antiquity, or to some inherent esthetic quality it possesses, or to a combination of factors, it has retained a ceremonial significance over a wide area, even where other crops now constitute the main sources of food. In sections of the Philippines where rice is the staple, taro is planted ceremonially and used in religious rituals.[43] Among the Central Enga of the New Guinea Highlands, sweet potato is the main food, but limited amounts of taro are distributed as prestige food.[44] On the island of Timor where it is believed root crops preceded rice as the staple foods, a taro leaf is still used in brands of ownership.[45] The geographer, William C. Clarke, has found that, "throughout the whole Pacific, taro is a crop with ritual and prestigious associations."[46]

It has already been stated as well as implied that sweet potato is an easier crop to grow than taro. Before examining the significance of this fact, the statement itself needs to be clarified and expanded. Gardeners on Bougainville-Buka, who have grown or who now grow both crops, readily state that the cultivation of sweet potato requires less effort and provides a larger and more reliable yield, than does the cultivation of taro.[47] There are several reasons for this. First of all sweet potato provides a higher yield per acre, in terms of both weight and calories. While precise quantitative information is not available comparing the yields of the two crops on Bougainville-Buka, using local gardening practices on local soils, data from other areas together with Oliver's Siwai data on taro, can provide a reliable indication of what could be expected on Bougainville-Buka. At Keravat, on New Britain, the DASF conducted sweet potato trials where yields of

over 25,000 pounds per acre were obtained,[48] and A. J. Kimber states that this would be a good estimate for all low-lying areas of Papua New Guinea.[49] In Siwai when taro was the staple, Oliver found that "151 pounds of edible taro" were grown in each 450 sq. ft. plot[50]--which amounts to about 14,600 pounds per acre. Even though, on the average, taro has about 12.5% more calories per pound than sweet potato,[51] the much greater yield of sweet potato, more than compensates for this difference. In fact the actual yields of sweet potato per acre per year on Bougainville are probably much larger than the 25,000 pounds per acre Keravat figure, which was for a single crop only. Donald Mitchell found that the Nagovisi of Southwestern Bougainville obtained up to four consecutive sweet potato crops from the same piece of land and that the yields decreased by only 25 percent for the second crop and only dropped another 25 percent for both the third and fourth crops.[52] The fact that the Nagovisi and many other groups[53] obtain multiple sweet potato crops from the same land emphasizes the less demanding requirements of this crop with regard to soil fertility. All available information on taro cultivation on Bougainville-Buka indicates that traditionally, only a single crop of taro could be obtained at a time--the next crop had to wait for years of bush fallowing to replenish the nutrients taken from the soil by the earlier crop. Fallowing periods for taro on Bougainville-Buka varied considerably from area to area. Oliver found that the Siwai waited only about six years before replanting taro on the same land,[54] Donald Mitchell reported a figure of about 25 years from Nagovisi,[55] and Blackwood reported what would amount to even a greater period in Northern

Bougainville.[56] With the less-demanding requirements of sweet potato, such long fallowing periods would be expected to diminish. Interviews in 1973 at Kongara (Nasioi area) and Buka indicated that fallowing periods as low as three to five years are used for both taro and sweet potato. Finally, sweet potato is easier to grow because of "its relative freedom from pests and diseases."[57]

If the population of Bougainville-Buka continues to increase at its present rate (over 3.5 percent annually),[58] the less demanding land requirements of sweet potato will become increasingly significant. Indeed they have already become important in some areas. In Nagovisi, because of the spectacularly greater productivity of sweet potato over taro, Donald Mitchell found that although the population has approximately doubled since the war, no additional land has had to be brought into the gardening-bush-fallowing cycle. In other words, the same amount of secondary forest land which was previously utilized in the taro growing agricultural cycle before the war is now, because of the switch to sweet potato, being used to support about twice the previous population. No additional primary forest has had to be cleared since the war.[59]

The labor requirements for sweet potato cultivation are generally considered to be less than those for taro cultivation. H. C. Brookfield states that in Western Melanesia, by changing from taro to sweet potato, "higher yields are obtainable for equal or less input."[60] The previously mentioned greater yields per acre, which are further enhanced through multiple cropping, mean that much less time is spent clearing land each year. Less weeding is usually required for sweet potato

because the vines quickly grow to form a good ground cover which considerably limits the number of weeds. Kimber found that, "Once the ground is covered weeding is easily and quickly done and depending on climatic conditions, two to five weedings are required before this stage is reached."[61] Another advantage of the vining nature of sweet potato is that any section of vine, even sections are short as one foot or less, can be used as planting material.[62] Thus, contrary to the situation existing with taro, there is an enormous amount of readily available planting material.

One result of all these factors which make the growing of sweet potato easier than the growing of taro is that being a good subsistence gardener has probably lost some of the respect it once had. Statements made in 1973 in many of the areas visited on Bougainville and Buka implied that growing sweet potato successfully was really not much of an accomplishment. It was claimed that one has only to "throw away" a section of sweet potato vine onto the ground and it will put out roots and begin growing like any wild bush vine. This sentiment has probably functioned to help stimulate the widespread postwar interest in cash cropping. Oliver has pointed out that traditionally, the most important way to gain prestige was to become a famous feast-giver.[63] And being a good subsistence gardener, or being able to coordinate and mobilize those who were, was a necessary aspect of this process. But nowadays, writes Oliver, "several other kinds of activities have acquired prestige-enhancing qualities."[64] Among those he lists, is "money-making," which in most cases on Bougainville-Buka, means cash-cropping.

It should be apparent that the decreases in labor and land requirements for sweet potato have also favored the development of cash-

cropping. Barrau found that in Melanesia generally, there was a positive correlation between the reliance on easily grown introduced food plants and the production of cash crops.[65] While it is probably true that in most areas, cash-cropping first acted to encourage these adoptions of introduced crops, rather than vice-versa, the correlation still holds true for Bougainville-Buka.

The switch from taro to sweet potato did not occur without some problems. Oliver noted that one drawback of producing sweet potatoes was that, "they are more tempting to pigs and require sturdier fences than taro gardens do." He added "it is said that pigs will exert greater effort to break into a sweet potato garden."[66] The patrol reports of the 1950's from the Nagovisi area indicate that there were continuing problems with pigs causing destruction of sweet potato crops. One patrol officer even claimed that "the majority of natives" of the Nagovisi area were "underfed," because of the "lack of food... owing to the devastation caused by pigs in the area."[67] It is difficult to know whether the situation was actually this serious, but the reports do show that for years the owners of pigs refused to enclose them, even though sweet potato gardens continued to be damaged. There was no tradition of keeping pigs penned up, nor did the Nagovisi deem it worthwhile to build pig-proof fences around their sweet potato gardens. During the same period, there were similar problems on Buka. Even though freely-roaming pigs were causing "great garden depredation," and patrol officers had consistently issued instructions for the pigs to be penned, the people were "extremely loath to follow out these instructions," claiming that pigs had died when kept in pens.[68] Patrol

Officer B. A. McCabe, insisted that the pigs had died in pens from "lack of food, water and shelter," and with threats of eventual court action against the pig owners, persuaded ten villages to raise the money necessary to purchase wire pig-fencing.[69] Today the practice of confining pigs to certain areas (usually large) has become more widespread. In 1973, an Aropa Valley woman was observed being threatened with a fine by the Local Government Council if she continued to allow her pig to freely roam about.

There has been another problem with the substitution of sweet potato for taro as the staple crop. In Southern Bougainville, especially in Buin and Siwai, where the land is only gently sloping and there are broad alluvial plains, gardens are subject to frequent flooding. The relatively level land in this region together with the very high rainfall combine to worsen this problem. Since the war, the Administration has seen fit to provide food to the people of Buin and Siwai on three occasions, during the years of 1957, 1965, and 1972, in order to alleviate food shortages resulting from heavy rains and flooding. In addition during 1959, Cadet Patrol Officer R. W. McLellan, reported that, "heavy rains caused some damage to crops of the staple food kaukau."[70]

Concerning the 1957 period of heavy rains, an August Patrol Report from Siwai stated the following:

> ...my patrol entered Siwai at a bad time: during the heavy rains which were subsequently to wash away some kaukau gardens and thoroughly soak the remaining gardens causing some of the kaukau to rot...All throughout the Siwai kaukau gardens were affected...It was found that there was a definite food shortage (although not a serious one).
>
> With the food shortage as it is the Siwai people have resorted to their old standby food--sago. ..It is to be

> remembered that with the rain devastation only the kaukau was harmed. The other food items listed [rice, peanuts, and corn]...are still in a reasonably plentiful supply.[71]

In a Buin Patrol Report, also from August of 1957, K. Graham, declared that there was "a threatened food shortage throughout the Buin Linguistic Area." But, stated Graham:

> the cause of the impending shortage is not so much the actual rain damage, although this is extensive, but that the prolonged wet spell has prevented the establishing and planting of new gardens which should have been prepared five months ago. However, should the gardens have been planted at this time, they also would have been badly damaged.[72]

Graham went on to recommend, that since there was no substitute for sweet potato, and sago and coconuts were in short supply, "assistance is estimated as necessary...for 4-5 months."[73] He also noted that of the small amounts of rice and peanuts which were being grown, the more mature plants had survived the inundation.[74] In a later report Graham stated that the government food assistance had ended by the middle of December.[75]

In 1965[76] and again in 1972 similar prolonged rainy periods occurred, the latter period beginning with the arrival of a cyclone in May 1972.[77] In both cases government food was provided as in 1957. An official DASF report on the 1972 food shortage reached the following conclusion in October of that year:

> Food production in subsistence gardens in the Buin Subdistrict has been severely curtailed by flooding and/or waterlogged soil conditions since June 1972 and gardens will not be back to normal production until about December or February 1973, providing normal weather conditions prevail.[78]

The above report also mentioned that kong kong taro (*Xanthosoma* spp.) had not been so severely affected and that sweet potato planted in unusually high (for this region) mounds, had produced larger tubers during the rainy period than those of neighboring gardens. The Assistant D.C. at Buin, M. Lang, after noting that taro had been the traditional staple before the war, wrote: "The people say that taro was not affected by high rainfall conditions to the same extent as sweet potato and in traditional times this factor enabled them to survive conditions like the present."[79] Interviews with residents of Buin and Siwai, in 1973, found agreement with Lang's report that taro had better withstood very wet conditions.

A primary drawback to depending on sweet potato in the Buin-Siwai area, then is its intolerance to waterlogged soil. Unlike taro, which thrives "in shady, damp, and even swampy places,"[80] sweet potato needs "light, well-drained soils," or "other types of soil with good artificial drainage."[81] Thus the problem is that sweet potato is not as ecologically suited to the conditions of Southern Bougainville as was taro. Until the people of this region begin to compensate for this fact, as many New Guinea Highlands people have done with their networks of high mounds and deep drainage ditches, they will continue to have periodic food shortages. However the chances of such changes occurring appear to be remote, for it seems likely that as long as the government continues to offer relief food supplies and the people continue to have enough cash to purchase a little rice to tide them over, they will be content to stick with their current gardening practices.

Finally, something should be said about the nutritional changes which resulted from the switch from taro to sweet potato. As previously discussed, the typical reaction to the necessary reliance on sweet potato immediately after the war, was that without taro, people would lack the required strength and stamina to resume their normal everyday life. Also mentioned earlier, was the widespread belief among taro eaters, that because of the feelings of satiety provided by taro, it is superior to other starchy foods. The questions which arise are, to what extent can these popular beliefs about taro be substantiated, and what were the nutritional effects of the switch to sweet potato? The ideal solution to the latter question, scientifically, would be to determine the exact amounts of taro normally consumed by people in a specific village before the switch to sweet potato. Then the exact present-day consumption of sweet potato, grown on the same soil as the taro, should be determined. The results of a nutritional analysis from samples of both crops should be obtained so that an exact comparison of the daily intake of protein, carbohydrates, vitamins, etc., could be made. Only by this method could the precise nutritional changes be determined. In the absence of such information, only the approximate nutritional differences between taro and sweet potato can be considered.

Table 1 shows a comparison of the nutritional breakdown of 100 g of raw taro vs. 100 g of raw sweet potato. The figures for each category are mean values calculated by Dr. Margaret McArthur of Sydney University from reliable but divergent results of different nutritional analyses of samples of the two crops. The comparison shows that in the important category of protein, taro contains over 40% more than sweet

TABLE 1

Nutritional Comparison of Taro and Sweet Potato

Based on 100 g Raw Samples

	CAL.	PROTEIN(g)	FAT(g)	CA(mg%)	FE(g)	VIT-A(g)	THIA(mg%)	RIB(g)	NIA(g)	VIT-C(mg%)
SWEET POTATO	128	0.95	0.1	25	0.7	0.04	0.11	-	0.70	37
TARO (*Col.* spp.)	144	1.4	0.2	42	-	0.01	0.27	-	0.20	6

potato. Taro also contains 12% more calories per 100 g than does sweet potato. Thus the claims that taro is more filling than sweet potato and that it provides more strength-giving nutrition are borne out, at least to a certain extent. The significance of these differences in the daily lives of the people of Bougainville-Buka, however, is very difficult to assess. It would appear that any decrease in protein intake resulting from the change from taro to sweet potato, would be made up for in part by the increased consumption of tinned meats and fish[82] which has occurred in recent years, due to the presence of cash income.

Chapter IV Notes

1 D. A. M. Lea, "Staple Crop and Main Sources of Food," in *An Atlas of Papua and New Guinea* (Port Moresby: Dept. of Geography, UPNG, 1970), pp. 54-55.

2 *Both Sides of Buka Passage* (Oxford: Calrendon Press, 1935), Chapter XII.

3 *Ibid.*, p. 440.

4 Buka Patrol Report, February 14, 1946, PNG NA, Bougainville District PR, 1943-46.

5 Personal communication to author.

6 Interview with Karari of Lemanmanu, December 21, 1973.

7 *Business and Cargo* (Canberra: New Guinea Research Unit, Bull. no. 44, 1972) pp. 38, 115.

8 See William C. Clarke, "A Change of Subsistence Staple in Prehistoric New Guinea" (1973), a paper given at the Third International Symposium on Tropical Root and Tuber Crops., for a discussion of the respective soil fertility requirements of taro and sweet potato.

9 Kirk Shoffner, personal communication to author.

10 Personal communication of author.

11 *A Solomon Island Society* (Boston: Beacon Press, 1955), p. 34.

12 *Both Sides of Buka Passage*, p. 272.

13 Expressed to the author on numerous occasions during stays in Western Samoa.

14 Francoise Panoff, "Some Facets of Maenge Horticulture," *Oceania*, 40 (1969): 29.

15 *Ibid.*

16 *Both Sides of Buka Passage,* p. 308.

17 *A Solomon Island Society,* p. 26.

18 *Ibid.*, pp. 178-80.

19 p. 210

20 p. 210

21 p. 213

22 pp. 367-68

23 Interview with residents of Rumba Village, November 13, 1973.

24 Interview with residents of Bakatong Village, November 14, 1973.

25 Witnessed by the author at Tsirombana Village on November 5, 1973. (tasted by the author's wife)

26 Interviews in both areas, 1973.

27 *A Solomon Island Society*, p. 135.

28 *Ibid.*, p. 299.

29 *Both Sides of Buka Passage*, p. 301.

30 *Ibid.*, p. 302.

31 pp. 304-307

32 Interviews at both places, November, 1973.

33 Interview with Pokanu of Kinilui Village November 23, 1973. A kinsman among those present was very embarrassed at the revelation of this secret in the presence of non-family members.

34 Interview with Baro of Bakalong Village, November 14, 1973.

35 Interview at Pariro, December 4, 1973.

36 Interview with Eric Wilson at Rabaul, October 15, 1973.

37 *A Solomon Island Society*, p. 498.

38 *Both Sides of Buka Passage*, p. 312.

39 Interview with Daisi from Hari Village, November 23, 1973.

40 Interview with Nara, mumi of Kohkui Village, November 26, 1973.

41 Interview with Thomas Uru of Kokare Village, November 1, 1973.

42 "The Sweet Potato in Subsistence Agriculture," *PNG Agric. J.* 23, nos. 3 and 4 (Dec., 1972), p. 79.

43 Douglas Yen *et al.*, Introduction of Taro into the Pacific: "The Indications of Chromosome Numbers," *Ethnology* 7 (1968), 264-65.

44 M. Meggitt, "The Enga of the New Guinea Highlands: Some Preliminary Observations," *Oceania* 28 (1958).

45 Douglas Yen, same as note 43, above.

46 Same as note 8, above.

47 Interviews on Bougainville-Buka, November-December, 1973.

48 A. J. Kimber, same as note 42, above, p. 90.

49 *Ibid.*

50 *A Solomon Island Society*, p. 479.

51 From a chart compiled by Dr. Margaret McArthur of Sydney University, through calculation of mean values from several reliable but divergent published findings.

52 "Gardening for Money: Land and Agriculture in Nagovisi" (Ph.D. Thesis, Harvard University, 1971), p. 188.

53 See A. J. Kimber's article referred to above (note 42).

54 *A Solomon Island Society*, p. 479.

55 "Gardening for Money" (1971), see chapter on gardening techniques.

56 *Both Sides of Buka Passage*, p. 298.

57 A. J. Kimber, p. 94.

58 Douglas Oliver, *Bougainville: A Personal History* (Melbourne: Melbourne University Press, 1973), p. 185.

59 "Gardening for Money" (1971), chapter on gardening techniques.

60 *Melanesia* (London: Methuen & Co., Ltd., 1971), p. 84.

61 A. J. Kimber, p. 87.

62 *Ibid.*, p. 84.

63 *Bougainville: A Personal History*, p. 207.

64 *Ibid.*, p. 208.

65 *Subsistence Agriculture in Melanesia* (Honolulu: Bishop Museum, Bull. 219, 1958), p. 82.

66 *A Solomon Island Society*, p. 27.

67 B. B. Butcher, Nagovisi Patrol Report, December 28, 1951, PNG NA, Buin PR, 1950-53.

68 A. B. McCabe, Buka Patrol Report, Soh. 9 of 54/55, PNG NA, Sohano PR, 1953-55.

69 *Ibid.*

70 Buin Patrol Report, Paubake Area, October 1959, Buin Archives, Buin Sub-District Office, Buin PR, 1959-60.

71 Siwai Patrol Report, BOK: I/1957-58, August, 1957, Buin Archives, Boku PR, 1957-58.

72 Buin Archives, Buin PR, 1957-58.

73 *Ibid.*

74 *Ibid.*

75 Buin Patrol Report, Lugakei, January, 1958, Buin Archives, Buin PR, 1957-58.

76 Eric Edmundson, Buin Schoolteacher, personal communication to author.

77 M. Lang, Assistant District Comm., letter to D. C. Arawa, September 8, 1972, copy in DASF Office, Buin.

78 F. Arndt, Rural Development Officer, report to District RDO, Kieta, October 25, 1972, copy obtained from DASF, District H.Q., Kieta.

79 Same as note 77, above.

80 Jacques Barrau, *Subsistence Agriculture in Melanesia,* p. 41.

81 Emile Massel and Jacques Barrau, *Food Plants of the South Sea Islands* (Noumea: SPC, 1956), p. 25.

82 *Bougainville: A Personal History,* pp. 189-190.

CHAPTER V

Conclusion

This study has shown that most probably the taro blight was present in some areas of Bougainville-Buka several years before the war, but that after the war the resultant shortage of planting material helped to spread it more rapidly throughout the entire area. Exactly how or when the disease arrived will probably never be known with any certainty, but all available evidence suggests that it probably appeared in the Solomon chain first on Bougainville or Buka or perhaps as far south as the Shortlands. From the Shortlands it progressed south and east down the archipelago; the evidence simply fails to support the idea (held by some observers) that it originated farther down the chain and progressed in a northwesterly direction.

In the early years after the war the blight was quite serious in all low-lying areas of Bougainville-Buka. During this time, because of pressure from the Catholic missions on Bougainville, the Murray Administration became interested in trying to re-establish taro in the area. The DASF program to find resistant varieties and better cultivation techniques began with good intentions but very shortly collapsed because of equipment and personnel shortages and probably a lack of sustained interest by the Administration's higher officials. By the mid-1950's the government's position was that sweet potato and other crops were quite acceptable replacements for taro. Only in the 1960's was research on resistant varieties resumed by the DASF.

Without help from the government, the indigenous people searched for their own solutions to the new taro disease. Many found that taro

could still be grown in the mountains, but coastal dwellers struggled to find resistant varieties. The Buka people succeeded in finding some which are partially resistant but have still not been able to resume taro production as it existed before the blight. In fact, throughout the low-lying areas of Bougainville-Buka, from all indications, sweet potato is still the most important food; taro is only eaten occasionally. In Buin and Siwai, taro growing has been a total failure, owing to the exceptionally wet climatic conditions there.

The displacement of taro as the staple crop on Bougainville-Buka can be seen as yet another example of the historical decline of this crop throughout the Pacific and perhaps even throughout South and Southeast Asia. This decline might have begun when somewhere in Southeast Asia, centuries ago, rice was discovered as a weed growing in a flooded taro field--a theory mentioned by Haudricourt and Hedin in 1943[1] and since supported by such authorities as Carl Sauer[2] and Jacques Barrau.[3] The decline of taro growing in the Pacific area has been attributed to many factors, most of which involve outside influences on traditional ways of doing things. Sometimes the reasons were associated with collapses of traditional leadership and declines in population, especially in wet-land taro growing areas where labor-intensive terracing and irrigation were required.[4] In other cases modern economic pressures have favored the switch to crops requiring less labor.[5] As mentioned in Chapter IV, the decline of taro has often been associated with the growth of cash-cropping. This brings up the question of whether or not sweet potato would have replaced taro on Bougainville-Buka after the war, even without the advent of the taro blight. From the

prewar cultural importance and popularity of taro, from its continued importance in the mountainous parts of Bougainville today and from the continued interest in taro expressed by many villagers even in 1973, the answer must be that despite some probable increases in sweet potato production, taro would have remained the most important food crop. The example of Western Samoa may be pointed out again. Here, taro has traditionally been the staple and despite the increasing importance of cash crops competing for the extra labor required for its production, it is likely to remain so, because of the people's strong attachment to it. Such would probably have been the case on Bougainville and Buka, without the arrival of the blight.

It is hoped that this study will have helped to emphasize the importance of plant diseases in human history. The significance of introduced biological pathogens attacking human populations directly, has received consideration by historians trying to assess the impact of the European intrusion on Pacific Island societies. Now, especially with the recent advances of the taro blight into new areas in Micronesia, introduced plant diseases must be counted along with the introduced post-contact human diseases as part of the biological impact of European expansion in the Pacific area.

Chapter V Notes

1 A. G. Haudricourt and L. Hedin, *L'Homme et les plantes cultivées* (Paris: Gallimard, 1943), as cited by Jacques Barrau in "L'Humide et le sec," *J. of the Polynesian Soc.* 74 (1965).

2 Carl O. Sauer, *Agricultural Origins and Dispersals,* (Cambridge: MIT Press, 1969), p. 28.

3 Jacques Barrau, same as note 1, above.

4 Bryant Allen, "Wet-Field Taro Terraces on Mangaia, Cook Islands," *J. of the Polynesian Soc.* 80 (1971): 378.

5 Jacques Barrau, *Subsistence Agriculture in Melanesia,* (Honolulu: Bishop Museum, 1958), p. 85.

APPENDIX A

The 1973 Interviews and the Methods Used

From mid-October through December of 1973 I conducted oral history interviews with residents from 27 separate villages on Bougainville-Buka. The following table tabulates the interviews in terms of census districts, giving the number of villages represented and the number of interviews per census district. The Census Districts are listed in the order in which they were visited.

Table A.1

Number of Interviews and Villages Represented per Census District

Census District	Villages Represented	Interviews
1. South Nasioi	6	9
2. Kongara	2	7
3. Siwai	6	8
4. Paubakei	2	2
5. Makis	1	1
6. Lugakei	2	2
7. Teop	2	2
8. Sailo	1	1
9. Buka	4	9
10. North Nasioi	1	1
Totals	27	42

The census divisions and the villages visited were selected mostly on the basis of practical considerations such as the availability of transport and accommodations. Within these limits a range of different environmental and cultural areas were included, as shown in the text.

The manner in which the interviews were set up varied from area to area. Often members of the DASF made arrangements for me to visit certain villages--the purpose of my visit was explained and I was introduced. Similarly, I was sometimes aided in these arrangements by mission personnel, teachers, government officers, and others, including two paid interpreters in South Nasioi and Kongara. In few cases, when no prior arrangements could be made or no introductions obtained. I was forced to visit a village on my own but with my wife accompanying me. In these cases, as well as in the better arranged interviews, I asked to talk first with the traditional leaders or "big men" (I used the indigenous term when known, e.g., *mumi* in Siwai or *oboring* in Nasioi). Then if there was time I tried to talk with other older men and women of the village. In interviewing women and even in approaching a village as a stranger I believe it was advantageous to have had my wife with me. The women seemed very pleased to see her and on occasions she was able to take photographs of them when I was refused such a request. Sometimes taro gardens were visited (especially in South Nasioi and Kongara), so that I could see firsthand how the oral explanations gathered were related to actual conditions in the garden. I was shown examples of most of the serious taro pests and diseases on these visits.

In conducting the interviews, I tried to keep in mind the established techniques and principles of good oral history interviewing. But because of certain practical considerations it was not always possible to adhere to all of the appropriate conventions. For example, it was not always possible to achieve optimum interviewing conditions. Often a large group gathered and it was difficult to politely interview

only a single person at a time. Sometimes younger "big headed" men tried to interrupt their elders in an attempt to gain attention by taking over and answering in English or a more understandable form of Pidgin. On other occasions during interviews with women, men would walk up and try to take over. Other conventions were better observed. As mentioned, I always asked to see the "big man" of the village first and usually succeeded (many times there were several "big men"). I refrained from asking leading questions. Rather than initially mentioning a taro disease, I asked which food had been the most important before the war, which food was most important after the war, and why the change. I did not use a questionnaire nor any sort of scheduled format. I tried to encourage the informants to simply tell me the story of how they had lost taro as their staple food. Often however this approach brought only a limited response, causing me to ask specific questions.

Usually the following questions were asked, but except for questions 1-3, not necessarily in the order shown (they were asked in Pidgin but the English equivalents are given here):

1) What was the most important food during the time of the ancestors? Before the war?

2) What was the most important food after the war? And now?

3) Why is taro no longer the most important food?

4) What happens when taro is planted? Does it grow?

5) When did this taro sickness first break out, and does it have a name in the local language?

6) Was it present before the war? Was it known during the time of the ancestors?

7) Photos of taro plants displaying virus-like disease symptoms were often shown. Informants were asked if such sicknesses were familiar and how long they had been present.

8) What are the names of the most serious taro diseases (sicknesses)? What do they look like and how long have they been present?

9) At present what is the most serious taro disease? When is the blight the most serious? During rain or sun?

10) If the informant had said that World War II bombing of spraying had spoiled the ground for taro, he has asked why sweet potato had not been affected, too.

11) Are there remedies (*medisen* in Pidgin) for taro diseases? For which diseases? What were these remedies and were they tried against the new sickness (the blight)? (This question was first asked only after an informant, in an early interview, volunteered that *medisen*(s) were used against certain taro diseases.)

12) Have you or has anyone ever asked the DASF for helping in growing taro?

13) Are there *medisen*(s) for sweet potatoes? Why not?

14) If taro were again plentiful as it used to be, would you like to eat taro everyday? Would you continue to eat sweet potato, too?

15) Are people in other areas still able to grow a lot of taro? Where do these people live and how are they able to do it?

16) Has taro ever been brought in from other islands? Did the Japanese bring any new taro? What foods did the Japanese bring?

The above is not a complete list of all questions asked. Sometimes not all of the above questions were asked; many times questions not listed were asked. The questions varied according to the course of each interview. But the questions listed are quite representative of what was asked in a typical interview.

Except in South Nasioi and Kongara where interpreters were employed, most of the interviews were conducted by me in Pidgin English. When I first arrived in Bougainville District, my Pidgin was very halting because I had had little practice after having gained some skill through the use of taped language lessons while still in Honolulu. But after about three weeks of intensive contact with Pidgin speakers, I was able to use the language with increasing facility. I found that most of those interviewed could speak and understand (even my) Pidgin quite easily. When older people were interviewed, sometimes a younger person more fluent in Pidgin, would act as an interpreter. When this happened I tried to make sure the interpreter told me exactly what was said rather than what he, himself, believed to be true. Since most of the older people were familiar with Pidgin they could correct the interpreter if he misrepresented what they had said. It is true that my Pidgin was never as good as that of the indigenous people or long-time European residents. A more experienced Pidgin speaker might have gathered more detailed and accurate information. However, because of the rather specific nature of the questions asked and the widespread agreement among the responses of different informants, I believe that most of the information I gathered was reliable.

As mentioned in the text, people in a given area (not surprisingly) tended to give the same responses and explanations as their immediate

neighbors, so that numerous local interviews became rapidly redundant. Because my interviews were limited to only ten of the 23 census districts on Bougainville-Buka, this redundancy undoubtedly reduced the amount of diverse information gathered. On the other hand, receiving the same information from many informants helped to establish that it was true or at least widely believed to be true.

BIBLIOGRAPHY

I Manuscript Sources

A Official

British Solomon Islands Protectorate

Department of Agriculture Correspondence, 1946-1950. Held at the Western Pacific Archives, Suva, Fuji, under BSIP List 1, files 2/7, 2/49, and 2/58.

Western District Touring Reports, 1949. Held at the Western Pacific Archives, Suva, Fuji, under BSIP List 7, files 36/4 and 60/4.

Papua New Guinea

Bougainville District Patrol Reports, 1945-1955. Held at the National Archives, Waigani.

Buin Sub-District Patrol Reports, 1956-1959. Held at the Buin Archives, in the Buin Sub-District Office of the Division of District Administration (DDA), Buin, Bougainville.

Department of Agriculture, Stock, and Fisheries (DASF) Correspondence relating to diseases of taro, 1947-1973. Held at the Chief Plant Pathologist's Office, Konedobu, under file 21-4-3.

DASF Correspondence, Reports, and Director's Tours, 1947-1957. Held at the National Archives, Waigani, under DASF files 1-2-2(H), 1-1-29, 32-1-30, and 32-2-9.

DASF Patrol Reports, Bougainville District, 1960, 1961, and 1972. Held at the DASF District Office, Kieta, under files 32-8, 32-2-4, and 32-1-C.

Department of Native Affairs Correspondence relating to agriculture, 1945-1946. Held at DDA headquarters, Konedobu, under files 6-4-9 and 6-4-11.

United States

Japanese Monographs (compiled by the U. S. Army, Far East Command), no. 127, S. E. Area Operations Record, Part IV, 8th Army Operations. Held at the Asia Collection of Sinclair Library, University of Hawaii, under Microfilm 397.

B Private

Clarke, William C. "A Change of Subsistence Staple in Prehistoric New Guinea." A paper presented at the Third International Symposium on Tropical Root and Tuber Crops. Will eventually appear in the Symposium Proceedings. University of Papua New Guinea, 1973.

Gollifer, D. E. and John F. Brown. "*Phytophthora* Leaf Blight of *Colocasia esculenta* (L) Schott in the British Solomon Islands Protectorate." Unpublished paper. Dala Agriculture Experimental Station, Malaita, BSIP, 1973.

McNeill, W. H. "The Influence of the Potato on Irish History." Unpublished Ph.D. Thesis. Cornell University; 1947.

Mitchell, Donald D. "Gardening for Money: Land and Agriculture in Nagovisi." Unpublished Ph.D. thesis. Harvard University, 1971.

II Printed Sources

A Official

Australia

Commonwealth Scientific and Industrial Research Organization. *Lands of Bougainville and Buka Islands, Papua New Guinea.* Papers by R. M. Scott, P. B. Heyligers, J. R. McAlpine, J. C. Saunders, and J. G. Speight. Melbourne, 1967.

B Newspapers and Periodicals

Monthly Notes of ASOPA (Australian School of Pacific Administration), 1946-1948. Sydney. After August 1947, the title changed to *South Pacific*.

New York Times, 1947. New York.

Pacific Islands Monthly, 1946-1947, 1949. Sydney.

C Books and Articles

Allen, Bryant. "Wet-Field Taro Terraces on Mangaia, Cook Islands." *J. of the Polynesian Soc.*, 80 (1971), 371-378.

Barrau, Jacques. "*L'Humide et le sec.*" *J. of the Polynesian Soc.*,

_____ *Subsistence Agriculture in Melanesia.* Bull. 219. Honolulu: Bishop Museum, 1958.

Biskup, Peter, *et al. A Short History of New Guinea.* Sydney: Angus and Robertson, 1968.

Blackwood, Beatrice. *Both Sides of Buka Passage.* Oxford: Clarendon Press, 1935.

Brookfield, H. C. and Dorren Hart. *Melanesia: A Geographical Interpretation of an Island World.* London: Methuen & Co., Ltd., 1971.

Butler, E. J. and G. S. Kulkarni. "*Colocasiae* Blight Caused by *Phytophthora colocasiae* Rac." *Memoirs of the Dept. of Agric. in India.* Botanic series 5, No. 4 (1913), 233-261.

Geiger, R. *The Climate Near the Ground.* Cambridge: Harvard University Press, 1957. Tr. by Milroy N. Stewart and others from 2nd German edition.

Gomez, E. T. "Leaf Blight of Gabi." *Philippine Agriculturalist.* 14, No. 7 (1925-1926), 429-441.

Hicks, P. G. "Resistance of *Colocasia esculenta* to Leaf Blight Caused by *Phytophthora colocasiae.*" *PNG Agric. J.* 19, No. 1 (July 1967), 1-4.

Kimber, A. J. "The Sweet Potato in Subsistence Agriculture." *PNG Agric. J.* 23, Nos. 3 and 4 (Dec. 1972), 80-102.

Lea, D. A. M. "Staple Crop and Main Sources of Food." in *An Atlas of Papua and New Guinea.* Port Moresby: Dept. of Geog., UPNG, 1970, 54-55.

Long, Gavin. *The Final Campaigns.* Canberra: Australian War Memorial, 1963.

Massel, Emile and Jacques Barrau. *Food Plants of the South Sea Islands.* Noumea: South Pacific Commission, 1956.

Meggitt, M. "The Enga of the New Guinea Highlands: Some Preliminary Observations." *Oceania* 28 (1958), 253-330.

Murray, J. K. *The Provisional Administration of the Territory of Papua New Guinea: Its Policy and its Problems.* Brisbane: Univ. of Queensland, 1949.

Odgers, Georges. *Air War Against Japan.* Canberra: Aust. War Mem., 1957.

Ogan, E. *Business and Cargo.* Canberra: New Guinea Research Unit, 1972.

Oliver, Douglas L. *Bougainville: A Personal History.* Melbourne: Melbourne Univ. Press, 1973.

_____ *A Solomon Island Society.* Boston: Beacon Press, 1955.

Panoff, Françoise. "Some Facets of Maenge Horticulture." *Oceania.* 40(1969), 20-31.

Parhem, B. E. V. "Annual report of the econ. bot. for the yr. 1948." *Coun. Pap. Fuji* 24(1949), 31-35. As summarized in *Review of Applied Mycology.* 29(1950), 251.

Purseglove, J. W. *Tropical Crops: Dicotyledons.* Vol. 1. New York: John Wiley & Sons, 1969.

Sauer, Carl O. *Agricultural Origins and Dispersals.* Cambridge: MIT Press, 1969.

Trujillo, E. E. "Diseases of the genus *Colocasia* in the Pacific area and their control." *Proc. int. Symp. trop. Root Crops, Trinidad, 1967.* 2, Section 4 (1969), 13-19.

_____ "The Effects of Humidity and Temperature on *Phytophthora* Blight of Taro." *Phytopathology.* 55, No. 2 (Feb. 1965), 183-188.

_____ *A List of Diseases of Economic Plants in the Trust Territory of the Pacific Islands.* Saipan: T. T. Dept. of Res. and Dev., 1971.

Trujillo, E. E. and M. Aragaki. "Taro Blight and Its Control." *Hawaii Farm Science.* 13(1964), 11-13.

Yen, Douglas and Jocelyn M. Wheeler. "Introduction of Taro into the Pacific: The Indications of Chromosome Numbers." *Ethnology.* 7(1968), 250-267.